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THIRD SERIES FOUNDED BY EDWARD JACKSON

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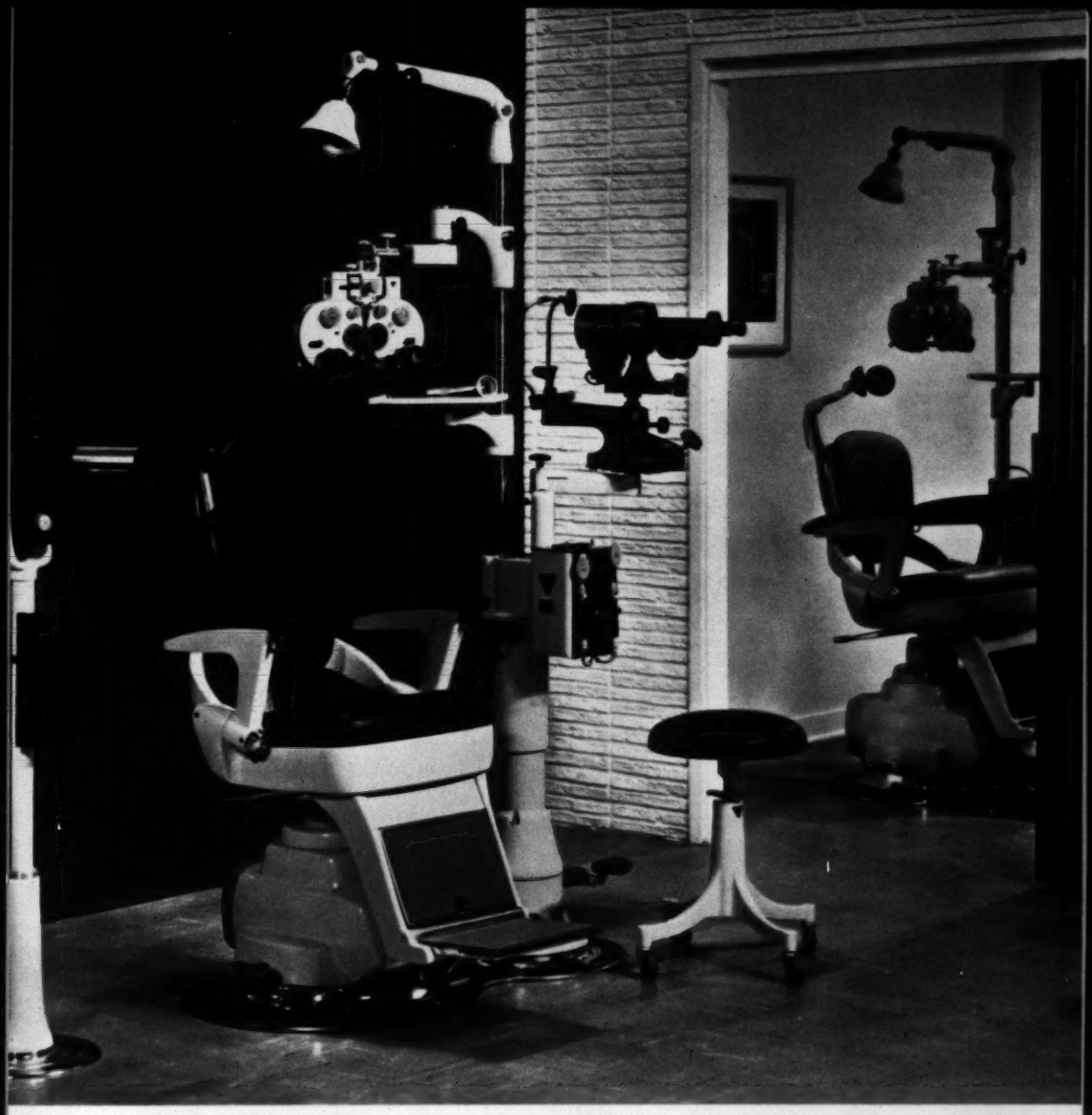

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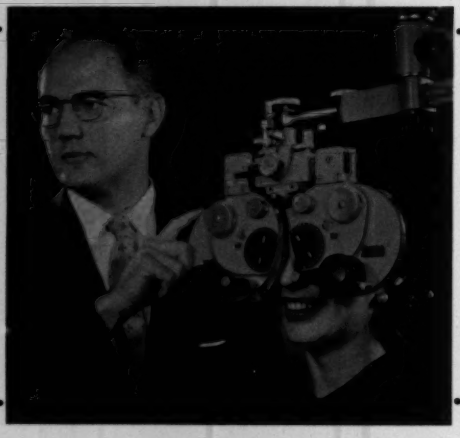

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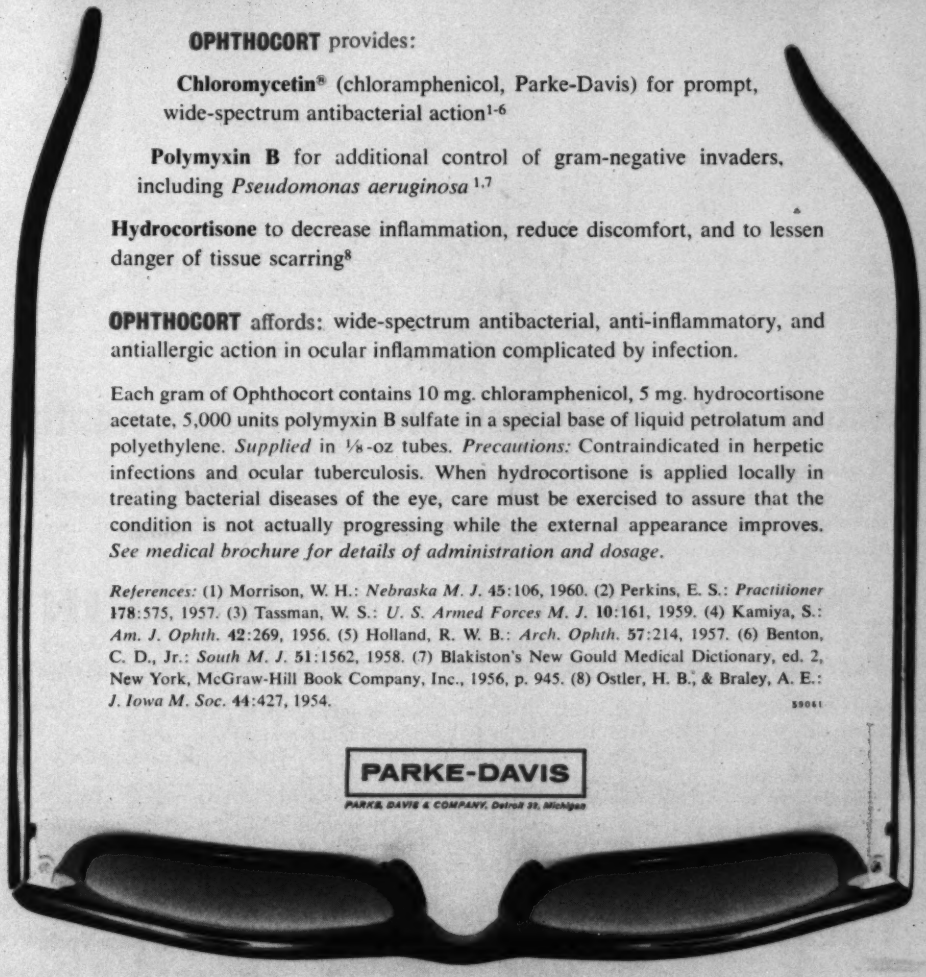

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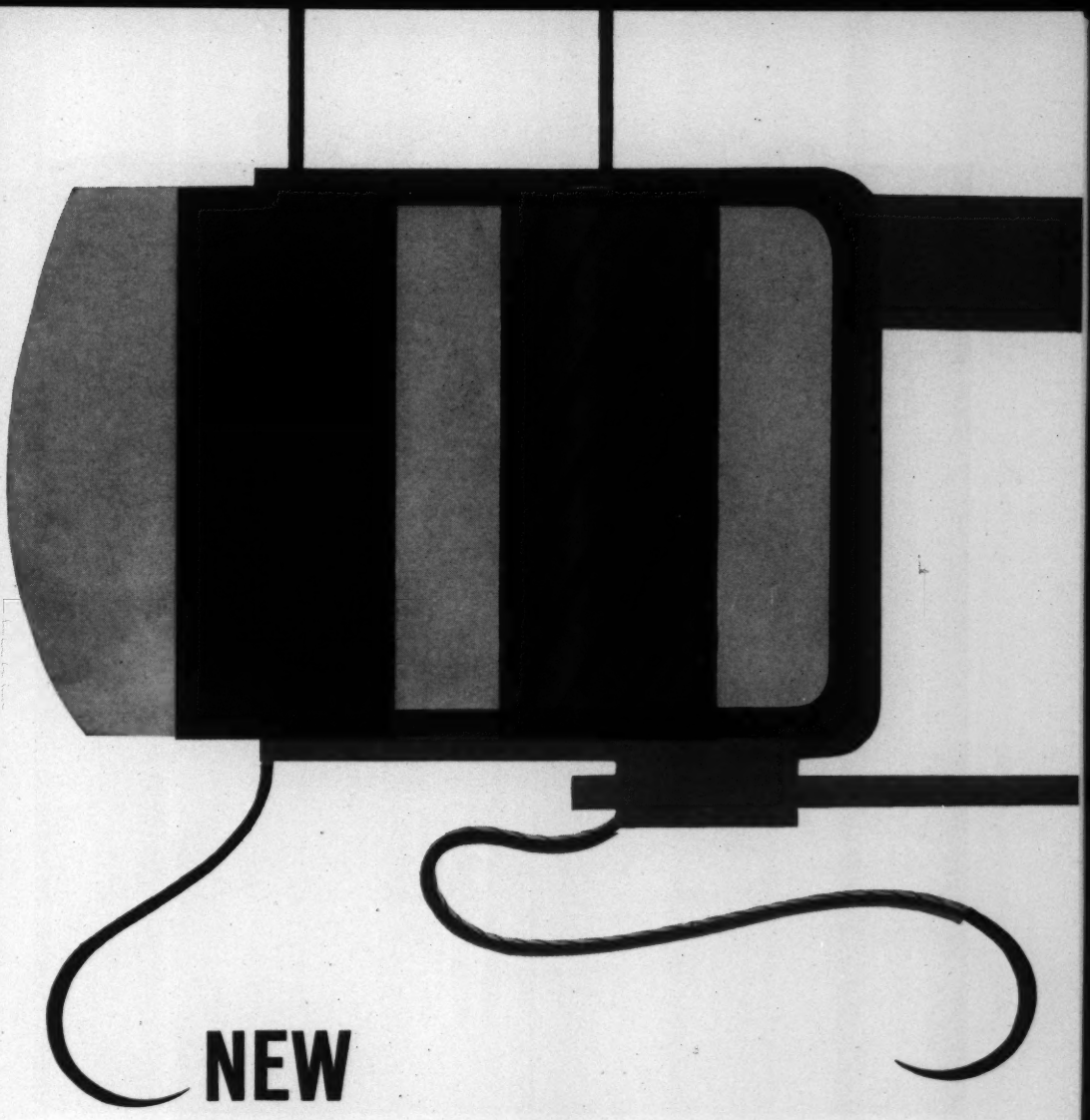

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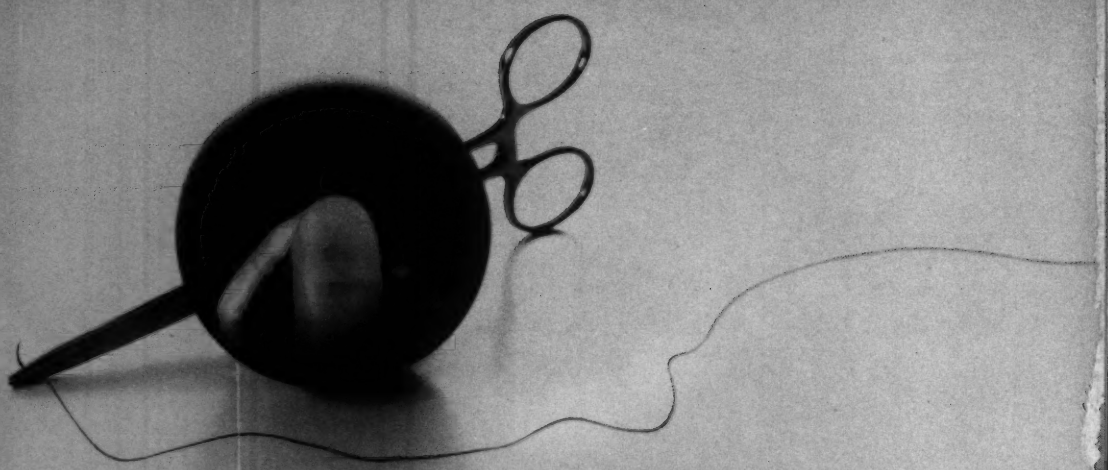

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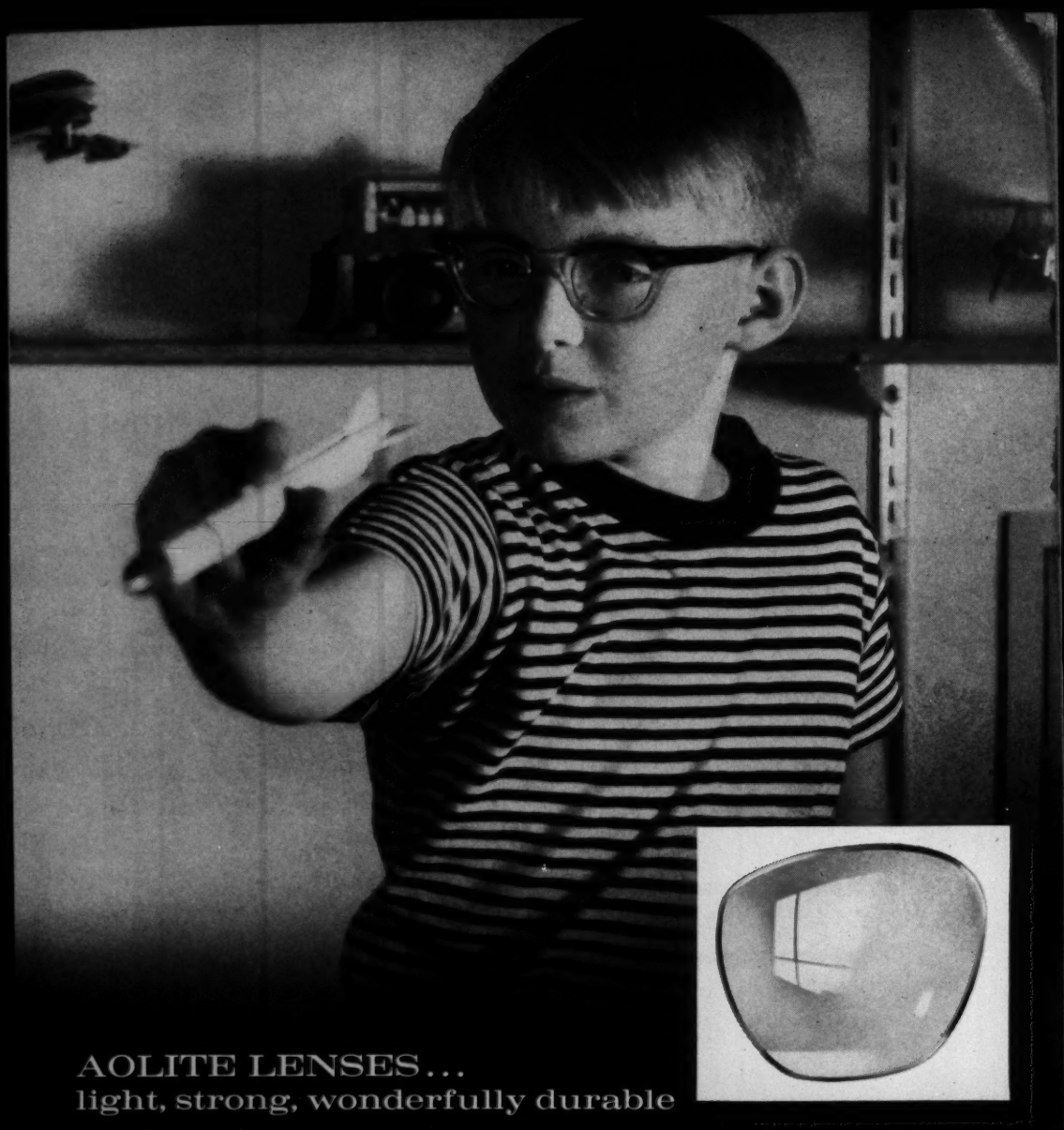

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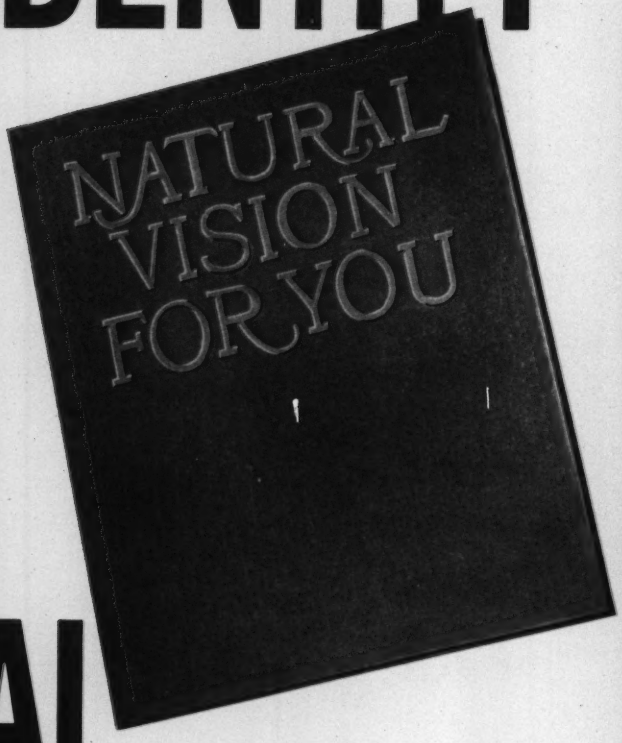

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 52 OCTOBER, 1961 NUMBER 4

SECONDARY REMOVAL OF RESIDUAL LENS CAPSULE AND CORTEX*

AFTER CATARACT EXTRACTION

ABRAHAM L. KORNZWEIG, M.D., AND FREDERICK H. THEODORE, M.D.
New York

The pupillary membrane requiring discission or removal, so frequent a complication in the days of the extracapsular cataract extraction, is now relatively rare. This is especially true since alpha chymotrypsin was introduced by Barraquer, enabling the operator to remove the cataract in its capsule in a high percentage of cases. Nevertheless, in the occasional case in spite of all precautions, the lens capsule ruptures and the lens cortex and nucleus have to be expressed with the Daviel spoon or muscle hook. Such remnants of capsule and cortex tend to be greater in amount and cover wider areas of the pupil than those encountered with the extracapsular cataract extraction, where the anterior lens capsule is removed with the cystotome or the Schweigger capsule forceps.

This complication had arisen in the four cases we are now reporting. In each case a planned intracapsular cataract extraction was attempted. Alpha chymotrypsin was not used in any of these cases, since they were all performed before this enzyme was in general use. In each case, the capsule ruptured during the extraction, and a considerable quantity of lens capsule and cortex was left behind.

The anterior chamber was irrigated with saline in an effort to wash out the lens cortex. Attempts to remove the capsule with a capsule forceps or a curved anatomic forceps were unsuccessful. The cataract incision was then closed with sutures and the eye allowed to heal.

The remnants of lens capsule and cortex were of such a nature as to block the pupillary area completely. In one case with a round pupil, peripheral iridectomy was done. In the other three cases a complete iridectomy above was performed. In all cases the vision was markedly reduced.

The eyes were observed for periods of from three to 12 months to permit absorption of the lens cortex and clearing of the pupillary area. In none of these cases was there sufficient improvement to give adequate vision.

In all of these cases the pupillary membranes were so thick or so odd that the usual needling procedure was considered impractical and perhaps even dangerous. The idea of removing the lens capsule and remaining cortex in its entirety was then conceived and executed. In one of these cases, this procedure appeared to be an absolute necessity because of the possibility of a sympathetic or phacoanaphylactic reaction in the other eye. In one other case the translucent and pearl-like capsule and cortex were suspended in the pupillary area; they looked almost like a small immature cataract. This case was the one which suggested the possibility for complete removal. While the objective was the same in all of these cases, the methods employed were modified to meet the needs of the particular situation. Each case will be reported separately.

* Presented at the VIII Congress of the Pan-Pacific Surgical Association, Honolulu, September, 1960.

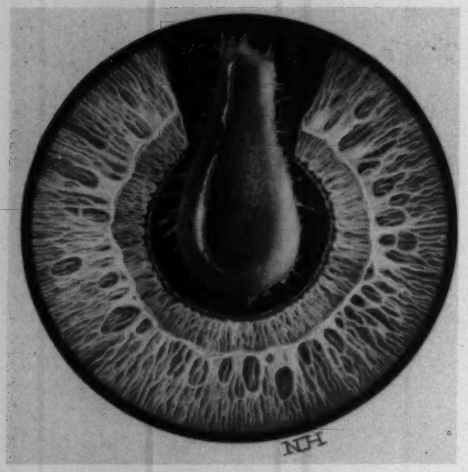

Fig. 1 (Kornzweig and Theodore). *Case 1.* The pupillary membrane resembled a small pearl-like semitranslucent structure situated directly in the pupillary area.

Case reports

Case 1

S. N., a woman aged 75 years, had a combined intracapsular cataract extraction in the left eye on Januray 14, 1957. The operation and postoperative course were uneventful and the result was good.

On June 5, 1958, the right eye underwent a similar procedure. The operation was complicated by rupture of the capsule. The lens could not be grasped with the Arruga forceps and an erisophake was used. The anterior chamber was irrigated with saline and some of the cortex was washed out. Considerable capsule and cortex remained behind. The wound was closed.

Postoperatively the lens cortex absorbed very slowly. Three months later, a mild iritis occurred, with a rise in intraocular pressure in this eye to 30 mm. Hg, as compared to 18 mm. Hg in the other eye. Six months later the pupillary membrane resembled a small pearl-like semitranslucent structure situated directly in the pupillary area (fig. 1). The vision was never any better than 20/200 with correction.

It was then that the idea of removing this structure in toto was conceived. On February 19, 1959, seven months after the initial operation, the patient was prepared as for a cataract operation, with preoperative sedation, pupillary dilation, and local anesthesia consisting of a Van Lint lid block and a retrobulbar injection of two-percent Zylocaine. The eyeball was massaged for five minutes. The lids were retracted with lid sutures and a superior rectus bridle suture was put in place.

A small conjunctival flap was dissected down to the limbus where an ab externo incision was made with the Bard-Parker knife through the sclera for about two-thirds of the thickness. Two McLean type 6-0 chromic catgut sutures were placed through the edges of the wound and looped out of place.

The anterior chamber was entered with a keratome and enlarged slightly with scissors. The anterior chamber was then irrigated with saline but the pupillary membrane did not budge. An Arruga forceps was put into the anterior chamber and the membrane grasped. The membrane was removed slowly and gently in order to watch for any adhesions to the vitreous face or iris structures. None were present and the membrane with its contents was removed completely, leaving a black pupil. The sutures were tied. The conjunctival flap was closed with plain catgut sutures, and a single eye dressing was applied.

The postoperative course was uneventful and the result was as if an intracapsular cataract extraction had been performed. Vision improved to 20/20 with correction.

Case 2

A. K., a 51-year-old woman, had had a successful round pupil intracapsular cataract extraction performed in the right eye on December 8, 1958. After an uneventful course following this operation, she was operated upon for a cataract in the left eye on January 5, 1959. At this operation the capsule tore, so that an extracapsular extraction with round pupil was done. Postoperatively, following an hyphema, an exceedingly thick and extensive secondary membrane was seen. It was clear that not only had the anterior capsule proliferated but

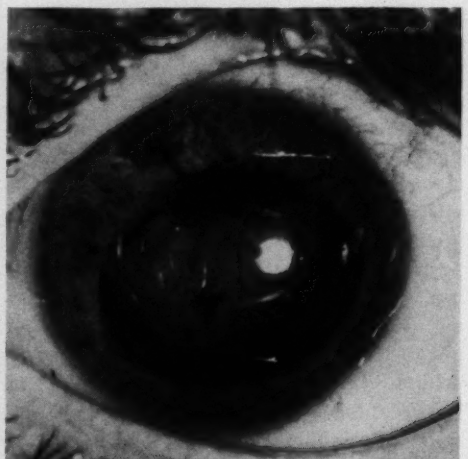

Fig. 2 (Kornzweig and Theodore). *Case 2.* The pupillary membrane consisted of a large central white mass of capsule and cortical material more than one mm. in thickness and seven mm. in diameter.

that much cortical material remained between the anterior and posterior capsules of the lens.

On January 30, 1959, the right eye (the one originally operated upon) developed a slight flare and cells in the anterior chamber, followed the next day by an acute congestive glaucoma in this eye. The patient was hospitalized. Treatment with miotics and Daranide was successful in reducing the tension and clearing the cornea. Gonioscopy revealed obliteration of the angle in almost all observable areas. Because of the possibility that the operation in the left eye had excited a sympathetic or phacoanaphylactic inflammatory process in the right eye, the patient was also given intensive systemic steroid therapy. She was hospitalized for six days with great improvement and return of vision to 20/25 in the right eye. After discharge, miotics and steroid therapy were continued for another 45 days.

Gonioscopy on March 26, 1959, revealed an open angle except from the 5- to 7-o'clock position, indicating that the glaucoma had indeed been inflammatory in nature.

With the subsidence of the disturbance in the right eye, attention was directed to the management of the secondary cataract in the left eye. This consisted of a central large white mass of capsule and cortical material, more than one mm. in thickness and seven mm. in diameter, projecting from a thick capsule which extended peripherally beyond the limits of the pupil. Only after maximal dilatation of the pupil, could a small crescent of vitreous face be seen inferiorly. The picture was such that anyone not present at the original operation might have wondered if the nucleus had been left behind (fig. 2).

The nature and density of this secondary cataract made it seem extremely unlikely that any type of needling would be successful in producing useful vision. Capsulotomy also seemed contraindicated because it was feared that any operation which would allow retained cortex to enter the anterior chamber might incite another acute inflammatory process in right eye. Gonioscopy indicated that the angle was full and that there was no adhesion of the capsule to the wound. For these reasons it was decided to attempt to remove the entire membrane and after-cataract. On April 15, 1959, the following procedure was done:

Operation. After the usual anesthetization, a scleral Flierenga ring was sutured to the muscles and to the underlying sclera in four places. Traction sutures were then attached to the ring to permit an assistant to hold up the eye as a precaution against vitreous loss. An incision was made at the limbus with a Bard-Parker knife and two McLean type sutures were placed. No conjunctival flap was made. The anterior chamber was entered with a keratome and the wound incised, mainly temporally. Another peripheral iridectomy was then made temporally; later it was decided to enlarge it, so a hook was inserted in the eye and a complete iridectomy was done and some posterior synechiae were freed.

Fig. 3 (Kornzweig and Theodore). *Case 2.* The pupillary membrane, consisting of capsule and cortical material, was completely removed, leaving a black pupil.

An attempt was made to grasp the secondary membrane with an erisophake but this failed. At this point, an Arruga capsule forceps was applied to the membrane, which was finally grasped with some difficulty. While holding the capsule with this forceps another forceps was used to grasp the capsule higher up. Then using these two forceps in a hand-over-hand maneuver, the capsule and its contents were gently peeled off the face of the vitreous and completely removed. The vitreous remained intact and undisturbed. The wound was cleansed and sutures tied. One-fifth percent Scopolamine was instilled and a monocular dressing applied.

Postoperatively there was practically no reaction other than marked descemetitis which cleared in about two weeks. Corrected vision of 20/20 was obtained (fig. 3).

CASE 3

I. B., a woman, aged 80 years, had poor vision in both eyes. Cataracts were present in both eyes but the one in the left eye was more advanced, with vision reduced to light perception. In the right eye, the best vision was 20/200. Since the left eye had always had poor vision, it was decided to operate on the right eye, even though the cataract was less mature.

On March 26, 1959, an intracapsular cataract extraction was attempted in the right eye. The capsule tore during the extraction, leaving considerable lens material and capsule behind which could not be irrigated out of the anterior chamber. The wound was closed and atropine instilled.

During the postoperative period there was only slight absorption of lens substance and vision was even poorer than before operation. Considerably emboldened by the success in the first two cases, it

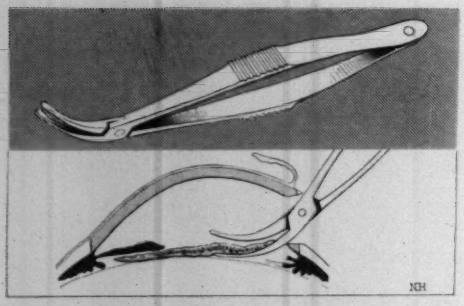

Fig. 4 (Kornzweig and Theodore). (Upper half) Bonacolto forceps—typical of the duckbill forceps used in this procedure. (Lower half) Demonstrates the method of removing the pupillary membrane by grasping it from above and below.

was decided to attempt a similar procedure on this patient.

On July 2, 1959, the right eye was re-operated. The preparation and anesthesia were as for a cataract extraction. A conjunctival flap was dissected down to the limbus from the 10- to 2-o'clock position. Two incisions were made about half-way through the sclera close to the limbus at the 11- and 1-o'clock positions. Two 6-0 chromic catgut sutures were placed through the edges of these wounds, as preplaced sutures, and looped out of the way. A sclerocorneal section was then made at the 12-o'clock position, and enlarged to the 10-o'clock and 2-o'clock positions, incorporating the original incisions. The anterior chamber was irrigated with saline but nothing could be washed out. An unsuccessful attempt was made to grasp the capsule with an Arruga forceps. A duck-bill forceps was then used and one blade was placed behind the membrane and the other blade in front (fig. 4). The capsular membrane and its contents were then slowly and gently removed, coming away in toto, and leaving a black pupil. There was no vitreous loss. The postoperative course was entirely satisfactory. The resulting vision of 20/30 was more than adequate for this patient's needs and no surgery on the other eye is contemplated.

Case 4

L. O., a woman aged 65 years, was first seen in 1953. An extracapsular cataract extraction had been performed on the left eye elsewhere, with an improvement in vision to 20/40. She developed secondary glaucoma in this eye, controlled with miotics. A typical secondary pupillary membrane developed in this eye and, in May, 1957, a discission was performed in a vertical direction with the Wheeler knife. The vision again improved to 20/30. In the meantime a cataract was gradually maturing in the right eye.

On December 4, 1958, a combined intracapsular cataract extraction was attempted on the right eye. Again the capsule ruptured and the operation was completed as an extracapsular cataract extraction. During the next few months the lens material absorbed slowly and incompletely, leaving a pupillary membrane that was thin above and thick below. The best vision that could be obtained was 20/70, and this was blurred and unsatisfactory.

A discission was considered for this pupillary membrane but, because of the thickness in the lower half of this membrane, it was ruled out. A complete removal, as in the previous cases, was considered and attempted on December 17, 1959, over one year after the cataract extraction.

The preparation for this operation was the same as for a cataract extraction. A limbus-based conjunctival flap was prepared. A trough was made in the sclera, near the limbus, with a Bard-Parker knife and two 6-0 chromic catgut sutures were preplaced before opening the anterior chamber with a keratome.

In this case, alpha chymotryspin, 1/10,000 dilution, was injected into the anterior chamber underneath the iris pillars. After a three-minute waiting period, the anterior chamber was irrigated with saline. However, attempts to grasp the membrane with the Arruga forceps and the duck-bill forceps were unsuccessful. It was then decided to make an opening in the membrane with a punch forceps.

As the membrane was grasped with the forceps, before completing the closure, it was seen to move with the movements of the forceps. It was gently extracted and came away completely, leaving no capsule or lens cortex behind. The pupil was black just as if an intracapsular cataract extraction had been performed. The postoperative course was uneventful. Final vision was 20/30 with correction, better than in the left eye because of a greater clarity.

Comments

A lens capsule that ruptures unexpectedly during a planned intracapsular cataract extraction is torn in an irregular and haphazard manner. The resulting pupillary membrane may be either very thin or very thick, or anywhere in between. Similarly, the amount of lens cortex retained in the capsule may vary from a minimal to a very considerable amount. Frequently the capsule rupture is small and considerable lens cortex is contained within the capsule. This seems to explain why occasionally it is so difficult to wash out such cortical material by irrigation, and why absorption is poor and incomplete in the postoperative period, in our cases from three months to one year.

Attempts to remove the entire capsule at this time have been described by Kirby[1] and Verhoeff.[2] But here we are dealing with an

eye that is half open and when the local anesthesia and general sedation are wearing off. The tendency is to irrigate out with saline as much of the lens substance as possible, and to make one or two attempts to grasp portions of the lens capsule that appear to be free with the forceps, and then to close the wound and hope for absorption of sufficient lens cortex to give adequate vision.

This procedure is preferred to possible loss of vitreous, which would greatly complicate healing and future attempts at further correction. Not infrequently the vision obtained in such cases is just as good as after most well performed extracapsular cataract extractions, and both patient and surgeon are satisfied. It is only in those cases where absorption of lens cortex is poor and a thick pupillary membrane remains to interfere markedly with vision that such a procedure as we have described should be considered.

The concept of complete removal of the after-cataract is not new. It is discussed under capsulectomy and capsulotomy by Spaeth,[3] Arruga,[4] and Kirby.[1] Meller[5] mentions it without discussion. Wiener[6] describes a method of complete removal of such a membrane using a toothed capsule forceps and short quick jerks to break the capsule or the zonule. Callahan[7] mentions it but warns of vitreous loss and subsequent complications. We wish to re-emphasize the importance of complete capsulectomy as a secondary procedure in attempted intracapsular cataract extractions complicated by capsule rupture. Such extractions should be classified separately as intra-extra cataract extractions to indicate their peculiar nature and the possibility of complete removal at a later date.

The use of alpha chymotrypsin as an aid in dissolving the zonular fibers should be kept in mind. In one instance (Case 4), alpha chymotrypsin was believed to have aided the procedure. In Case 2 it was considered but was not used because a small area of free vitreous face could be seen preoperatively and it was feared that the enzyme might harm the eye.

The surgeon should be prepared to use the type of forceps best suited to the particular case. A forceps designed to grasp the capsule in front and behind, such as a duck-bill forceps, should always be available.

The hand-over-hand technique using two forceps seems most efficient for the removal of secondary membranes of the type described. Although it has been mentioned by Verhoeff for the complete removal of the capsule at the time of an original cataract extraction, it seems to have a special indication in after-cataracts.

The patient should be prepared, as for cataract extraction, to obtain complete relaxation and prevent vitreous prolapse. Massage of the eyeball is always indicated. Although Flierenga's ring is cumbersome, time-consuming and requires an additional assistant, it may be a useful safety measure in certain cases. In conclusion, when such a case is encountered, the ophthalmologist would be wise to wait until the eye has quieted down completely and all possible lens matter has absorbed.

Frequent slitlamp examinations and even gonioscopy are indicated to determine if there are any adhesions of the vitreous or lens capsule to the wound. Even though complete capsulectomy by any of the procedures described may appear radical, it may, in the long run, be the safer; sometimes it is the only rational procedure. Successful and uncomplicated removal may result more often than expected.

Summary

Four cases of combined "intra-extra" capsular cataract extraction are presented, in which the residual capsule and lens cortex were removed in toto by a secondary operative procedure. Several methods for such complete removal are described, including the use of special forceps, a two-forceps hand-over-hand technique, and the use of Flierenga's ring as a safety measure. Alpha chymotrypsin was of value in the one case in which it was used.

1 East 63rd Street (21).
667 Madison Avenue (21).

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SCLEROCORNEAL TRANSFIXATION METHOD*

For the removal of posteriorly dislocated lenses

J. Spencer Dryden, M.D., L. Edward Perraut, M.D., and William H. Seward, M.D.
Washington, D.C.

A lens which has been dislocated posteriorly into the vitreous may be tolerated by the eye for many years. Eventually most of these eyes develop iridocyclitis or a secondary glaucoma. Many ophthalmologists feel that, if either of these complications occur, the luxated lens should be removed.[1-4] Chandler[5] removes a luxated lens from the vitreous only if it is hypermature and causing uveitis and glaucoma. Unless the lens is hypermature, he feels that the removal of the lens will have no effect on the glaucoma. Barraquer,[6] on the other hand, removes all luxated lenses whether complications have developed or not.

The multiplicity of surgical techniques which have been devised for removal of posteriorly luxated lens reveals the lack of unanimity among ophthalmologists on the surgical management of such a case. Duke-Elder,[7] in referring to the complications which occur with posteriorly luxated lenses whether treated medically or surgically, points out that these eyes often run a stubborn and stormy course, giving much pain to the patient, anxiety to the surgeon, and resulting in removal of the eye. Duane[8] states that "The extraction of a lens floating in the vitreous is impossible."

In 1885, Knapp,[9] dissatisfied with the results of removal of these dislocated lenses and fearing sympathetic ophthalmia, advised enucleation as the primary procedure in many cases. During this same year Agnew[10] devised an ingenious procedure (fig. 1) to bring the lens into the anterior chamber. This procedure made use of an instrument called a bident, which was inserted through the sclera on the temporal side and brought out on the nasal side of the eye just behind the iris.

During the next few years several cases were reported in which the technique described by Agnew was used with varying degrees of success. In most of these reports this method was used with the patient in the supine position.[11-12] Webster,[13] in a discussion of a report by Bonaccalto, stated that "on several occasions Dr. David Webster, Sr., turned the patient in a prone position, transfixed the lens by passing a knife needle, which entered the globe eight mm. behind the limbus and then turned the patient over in a supine position and completed the operation."

The most widely used method for removing a dislocated lens is the use of the loupe

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* From the Department of Ophthalmology, Washington Hospital Center. Presented at the annual meeting of the Episcopal Alumni Association, June, 1960.

or spoon.[14-15] Kirby[16] states that "if the lens is luxated into the viscid or semiviscid vitreous there seems to be no option but to use the loupe or spoon." Kreibig[17] uses the loupe but only on direct observation with the indirect ophthalmoscope.

Verhoeff[18] described a method in which irrigation of the vitreous cavity with a stream of saline caused the luxated lens to float up into the pupillary space from which it was easily removed.

Placing the patient in a prone position which allows gravity to bring the lens into the anterior chamber through a widely dilated pupil, is frequently mentioned as a method of removing a luxated lens. Unfortunately this method is rarely successful.

Recently, Barraquer[6] and Calhoun[19] have described a modification of the Agnew method using a double-pronged needle which is passed through the sclera five or six mm. behind the limbus to support the lens in the pupil. This procedure is carried out with the patient in the prone position, following which the patient is placed in a supine position to permit removal of the lens. Recently, without previous knowledge of this method, one of us (JSD) devised a somewhat similar procedure which is herein described. Others[3-14] have recommended that the lens be transfixed either with a diathermy needle or a knife, prior to removal with a loupe.

Most of these procedures have definite limitations and disadvantages. For example, Verhoeff's method is useful only if the vitreous is fluid and even then is not always successful. Probing into the vitreous body with a loupe is a hazardous procedure and often results in blindness. A similar result may follow use of the diathermy needle. The method described by Calhoun and Barraquer has appeared to be more satisfactory but the problems of vitreous loss with its associated complications have not been entirely eliminated.

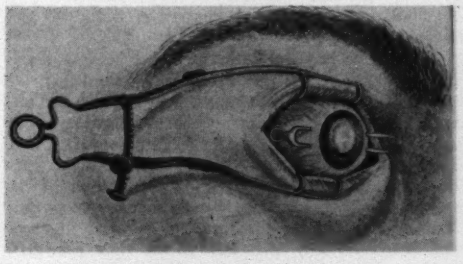

Fig. 1 (Dryden, Perraut and Seward). The Agnew bident.

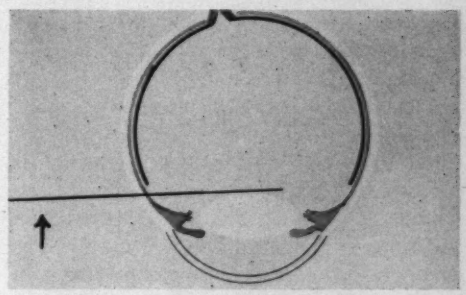

Fig. 2 (Dryden, Perraut and Seward). Schematic representation of Keith needle behind dislocated lens just prior to forcing the lens into the anterior chamber.

The purpose of this paper is to describe our method of removing posteriorly dislocated lenses and to report five cases in which this method was used. We believe this method has definite advantages over those previously described.

Technique

The patient is given the usual local anesthesia and placed in that position which will permit the lens to migrate to a position as near its normal anatomic location as possible. A Keith abdominal needle is then passed through the sclera (fig. 2) five or six mm. posterior to the limbus on the temporal side while fixation of the globe is maintained with a forceps on the nasal side. The needle is passed posterior to the lens until it reaches the pupillary margin on the nasal side. The proximal end of the needle is then depressed, forcing the lens into the anterior chamber and pressing it firmly against the posterior surface of the cornea. The needle is then carried through the pupil anterior to the nasal

half of the iris and out through the cornea on the nasal side. With this maneuver, the lens is held firmly in place in the anterior chamber and the vitreous is thus displaced posteriorly. The patient is then placed in the supine position and a combined cataract extraction is performed. Tight closure of the wound is essential. After completion of the extraction and closure of the conjunctiva, the globe is again grasped gently with fixation forceps on its nasal side and the needle is withdrawn. Postoperative management is similar to that of any cataract extraction.

Case reports

Case 1

A 55-year-old white man was first seen on December 10, 1958. He gave a history of having been struck in the right eye with a fist three days previously. The injury was followed by severe loss of vision and discomfort in the eye. Past history revealed that in 1934 the patient had sustained a penetrating wound to the left eye with a prolapse of the iris. This had been repaired but the vision remained considerably impaired.

Examination revealed the visual acuity to be hand movements in the right eye. Corrected visual acuity was 20/70 in the left eye but required a strong cylindrical lens at an oblique axis. The pupil of the right eye was dilated and fixed. The anterior chamber was deep and filled with vitreous. The lens was luxated, lying on the retina inferiorly, but it came up readily into the posterior pupillary space when the patient's head was tilted forward. The fundus appeared normal. The intraocular pressure was 18 mm. Hg (Schiøtz) bilaterally.

The left eye showed a traumatic coloboma of the iris in the lower temporal quadrant. The lens was clear and the fundus appeared normal.

The patient was admitted to the hospital and several attempts were made to trap the lens in the anterior chamber but none of the attempts was successful. The intraocular pressure began to rise and by the fifth day was 70 mm. Hg (Schiøtz). The glaucoma failed to respond to any form of medical therapy, and on the sixth hospital day the patient was taken to the operating room where the lens was removed, using our method already described. The patient was placed in the prone position for insertion of the Keith needle. When the lens had been secured in the anterior chamber the patient was returned to the supine position and a combined intracapsular lens extraction was performed with no loss of vitreous.

The postoperative course was uneventful. The patient's eye has remained quiet, and the highest intraocular pressure recorded was 25 mm. Hg. Corrected visual acuity in this eye was 20/30.

Case 2

A 55-year-old Negress was struck in the left eye with a shoe on January 1, 1959, causing a sudden diminution of vision and pain in the eye. She consulted a local ophthalmologist two weeks later who found the intraocular pressure to be 90 mm. Hg (Schiøtz) in this eye. Despite the use of miotics the eye continued to be painful. On January 31, 1959, the patient was first seen in the Eye Clinic.

Examination revealed the visual acuity to be 20/20 in the right eye; hand movements in the left eye. The right eye was completely normal. The left eye was deeply injected, the pupil was widely dilated and fixed and the cornea was very steamy. The intraocular pressure was 19 mm. Hg (Schiøtz) in the right eye and 71 mm. Hg in the left eye.

After clearing the cornea with glycerine, the anterior chamber was noted to be shallow and filled with vitreous and there was a moderately dense flare with a few cells. The lens was lying in the vitreous inferiorly and was bound down by vitreous bands. The vitreous was quite hazy and contained some blood. The disc appeared normal.

Gonioscopy revealed a normal open angle in the right eye; on the left eye angle structures were obscured due to the corneal edema.

In spite of intensive miotic therapy and Diamox the intraocular pressure could not be controlled and ranged from 38 to 90 mm. Hg (Schiøtz). The patient was presented to the weekly staff conference. Although the consensus was that the eye was hopeless, it was suggested that a combined cyclodialysis and cyclodiathermy be done as a last resort.

This procedure was done on February 9, 1959. Vitreous escaped through the cyclodialysis wound during surgery. Systemic and local steroids were started on the fourth postoperative day. When the patient was discharged on February 18, 1959, the intraocular pressure measured 8.5 mm. Hg in the left eye but one week later it had risen to 54 mm. Hg. She was readmitted to the hospital at which time systemic steroids were discontinued and Diamox was resumed.

On March 13, 1959, the lens was removed using the sclerocorneal transfixation method. The lens which was bound down by vitreous bands was brought anteriorly with the Keith needle but inadvertently the lens was pierced by the needle. However, all the lens material was removed and no vitreous was lost.

Postoperatively the patient did well and on April 10, 1959, (one month after removal of the lens), the left eye was white with no flare or cells in the anterior chamber. The intraocular pressure was 16 mm. Hg in the right eye; 18 mm. Hg in the left eye. The vitreous had cleared considerably and the fundus appeared normal except for some pallor of the nerve head. Corrected visual acuity was now 20/70 in this eye. Tonography revealed the coefficient of outflow to be 0.21 in the right eye; 0.09 in the left eye. On a subsequent visit the intraocular pressure had risen to 34 mm. Hg. The patient

was given Phospholine Iodide (0.125 percent) to use twice a day in this left eye. When the patient was last seen on May 22, 1959, the intraocular pressure was 18 mm. Hg bilaterally.

CASE 3

A 61-year-old Negro complained of loss of vision in the left eye since 1955 when he was struck in the eye with a fist. Visual acuity in the right eye had been poor following an injury 40 years ago. In 1955 an iridectomy had been performed on the left eye at another hospital following the injury.

The patient was first seen at Episcopal Eye, Ear and Throat Hospital* on May 25, 1957. Examination at this time revealed the visual acuity to be 20/200 in the right eye and 16/200 in the left eye. The intraocular pressure was 27 mm. Hg (Schiøtz) in the right eye and 34 mm. Hg in the left eye. The right pupil was small and reacted sluggishly to light while the left pupil was irregular due to a surgical coloboma of the iris superiorly.

Slitlamp examination revealed the anterior chamber of the left eye to be filled with vitreous and the lens was cataractous and subluxated. In the supine position the lens fell backward into the vitreous but was still attached by a few zonules superiorly.

Ophthalmoscopic examination revealed evidence of an old chorioretinitis and choroidal rupture involving the macula on the right, and a normal fundus on the left. Removal of the subluxated lens was advised but the patient refused.

He was not seen again until Januray 9, 1959. At this time examination of the right eye showed the same findings as before. Corrected visual acuity was 20/200 in the right eye and 3/200 in the left eye. The intraocular pressure was unchanged as well as the position of the lens of the left eye. The lens was definitely more cataractous. Ophthalmoscopy done with the patient in the supine position again revealed the left disc to be normal as well as the remaining retina. Visual fields done with a large test object revealed a normal field on the left while the right showed a large central scotoma. Because the patient was no longer able to work, he consented to have the lens of the left eye removed.

On March 20, 1959, the subluxated lens was removed using the sclerocorneal transfixation technique already described. In this case the transfixation was done with the patient sitting in an upright position. By April 10, 1959, corrected visual acuity in this left eye was 20/15 and the intraocular pressure was 15 mm. Hg (Schiøtz) in each eye. On June 10, 1959, tonographic examination revealed a normal coefficient of outflow in each eye. On August 7, 1959, tension was 18 mm. Hg in each eye and visual acuity in the left eye was 20/15.

CASE 4

A 45-year-old Negro came to the Eye Clinic on May 17, 1959, complaining of pain and loss of vision in his left eye. His symptoms began eight days previously when he struck his left eye on the edge of a cabinet.

Fig. 3 (Dryden, Perraut and Seward). Insertion of Keith needle with the patient in the prone position.

Examination revealed the patient's visual acuity to be 20/20 in the right eye and 3/200 in the left eye. With an aphakic correction the visual acuity in this left eye was 20/30. The intraocular pressure was 22 mm. Hg (Schiøtz) in the right eye; 24 mm. Hg in the left eye. The right eye was entirely normal. The left eye was moderately injected, the anterior chamber was deeper than that of the right eye, and contained vitreous. There was an aqueous flare along with a few cells. The lens was luxated, lying in the inferior portion of the vitreous cavity; however, it came up readily into the pupil when the patient was placed in the prone position. Five-percent homatropine and hydrocortone drops were prescribed.

When the patient returned the next day he complained of more severe pain in this left eye. The intraocular pressure had risen to 54 mm. Hg (Schiøtz). Tonography at this time revealed a coefficient of outflow of 0.09 mm. Hg in the left eye and 0.11 in the right eye.

Gonioscopic examination showed each angle to be open, but on the left there was a very heavy deposition of black pigment throughout the angle. On May 22, 1959, the patient was placed in a (figs. 3 and 4) prone position and the lens forced into the anterior chamber by the sclerocorneal transfixation method. The patient was then placed in a supine position (fig. 5) and the lens removed in a routine manner without loss of vitreous. An iridectomy was not done.

The immediate postoperative course was uneventful. After the patient was discharged from the hospital he experienced a rather stormy course. The left eye remained quite injected and irritable. The anterior chamber was shallow and the iris bowed forward as a result of a pupillary block. The tension remained normal until August 31, 1959, at which time it rose to 70 mm. Hg (Schiøtz). The patient was given intravenous Diamox and Phospho-

* Now the Ophthalmology Department of the Washington Hospital Center

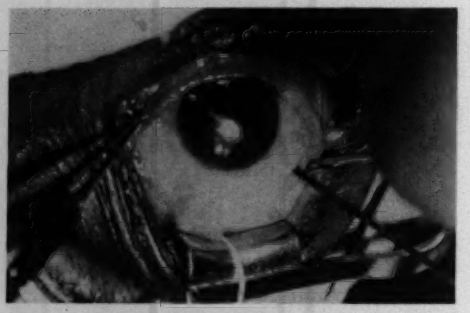

Fig. 4 (Dryden, Perraut and Seward). Keith needle in position behind luxated lens just before the needle is brought forward anterior to the nasal leaf of the iris.

line Iodide topically and responded well to this therapy.

On September 22, 1959, tension had again risen to 42 mm. Hg and the patient was readmitted. The following day a combined peripheral iridectomy and cyclodialysis was done on this left eye. The patient did well postoperatively with definite deepening of the anterior chamber. He experienced one further acute rise of tension in this eye in December, 1959. Phospholine Iodide twice daily was prescribed and has since controlled the intraocular pressure quite well.

CASE 5

A 62-year-old Negro was first seen in the Eye Clinic in August, 1959, at which time he stated he had been struck in the right eye by unknown assailants. Examination at that time revealed the visual acuity to be 20/50 in each eye.

Slitlamp examination revealed partial subluxation of the lens and a traumatic iridocyclitis of the right eye. Intraocular pressure was 9.0 mm. Hg (Schiøtz) in the right eye and 13 mm. Hg in the left eye. One week later the tension had risen in the left eye and the patient was started on two-percent pilocarpine in this eye four times a day.

Gonioscopic examination revealed open angles in both eyes but there was noted to be an excessive amount of pigment in the inferior angle of the right eye. The intraocular pressure remained normal in this right eye but the eye was irritable and photophobic.

On October 23, 1959, the patient was taken to the operating room and the Keith needle was inserted with the patient in an upright position. The lens capsule broke during delivery and some fluid vitreous was lost. A clear pupil was noted at the completion of the operation. The postoperative course was uneventful. The right eye showed a tension of 27 mm. Hg (Schiøtz) on December 16, 1959, and the patient was placed on Phospholine Iodide twice a day. Since that time the intraocular pressure has remained normal and the corrected visual acuity in this right eye is 20/50.

DISCUSSION

This sclerocorneal transfixation method was used quite effectively in five cases with a minimal vitreous loss occurring in only one case. Complications have occurred in only two cases. We feel that these complications could have been avoided. In Case 4, in which an iridectomy was not done, the patient developed glaucoma due to a pupillary block. This could have been avoided by doing an iridectomy at the time of lens extraction. In Cases 2 and 5, more skillful use of the Keith needle might have prevented an extracapsular lens extraction but the visual results were not affected by this complication.

In our opinion, this method of removal of posteriorly dislocated lenses has the following advantages:

1. As the lens is forced into the anterior chamber against the back of the cornea the vitreous is displaced posteriorly, minimizing the hazard of losing vitreous.

2. The Keith needle supports the lens, preventing it from falling back into the vitreous when the eye is opened.

3. The needle supports the entire globe, preventing it from collapsing after the eye is opened, which further minimizes the danger of losing vitreous.

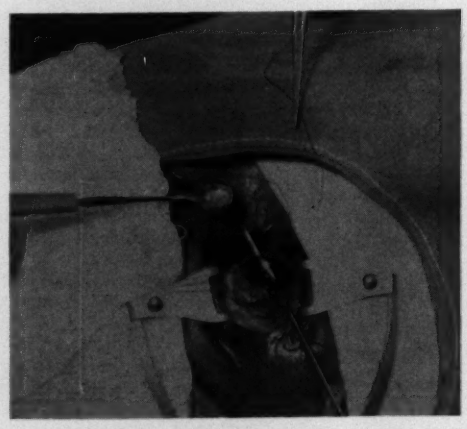

Fig. 5 (Dryden, Perraut and Seward). Keith needle still in position following extraction of luxated lens. The eye shows no tendency to collapse.

4. A lens which has become fixed in the vitreous, as was described in Case 2, can be mobilized.

We feel that the single-bladed needle is superior to the double-pronged needle because it has greater maneuverability and is less traumatic, since the sclera is penetrated only once. This would tend to reduce the incidence of complications such as retinal detachments and vitreous hemorrhage. By inserting the needle no farther back than six mm. from the limbus the chance of producing a retinal detachment is reduced. It also enables one to press the lens firmly and securely against the back of the cornea. Wedging the lens against the cornea is a most important step and probably accounts as much as anything else for our losing vitreous in only one case.

The Keith needle was used in our first case as a matter of expediency and has served as well in the four succeeding cases. We now have under consideration a new single-bladed instrument for this purpose.

The operation, using this method which we described in our series of five cases, has been performed by three different surgeons, which indicates that the procedure is reproducible.

We have noted in a number of eyes with dislocated lenses that the angle contains an unusual amount of pigment. We have wondered if this may in some way be related to the elevation of the intraocular pressure.

In view of our results in these five cases, and being aware of the ultimate adverse effects of a posteriorly dislocated lens, we agree with Barraquer that all dislocated lenses should be removed whether complications have ensued or not.

Summary

We have reviewed the literature concerning the surgical management of posteriorly luxated lenses. A technique using a single-needle sclerocorneal transfixation method is presented. Five cases are reported in which this technique was successfully used. The advantages of this technique are discussed.

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PHOTOCOAGULATION AS AN ADJUNCT IN RETINAL DETACHMENT SURGERY*

BAYARD H. COLYEAR, JR., M.D. AND DOHRMANN K. PISCHEL, M.D.
San Francisco, California

Of the many uses to which photocoagulation can be put, the majority are in connection with treatment of diseases of the retina and in particular management of retinal detachment.[1-7]

In an earlier paper[8] we discussed our experience with light coagulation in the prevention of retinal detachment and in the treatment of retinal breaks without associated separation of the retina. It is our feeling that retinal breaks in the retina are best treated by light coagulation in preference to electrodiathermy if there is no elevation of the surrounding retina. The prophylactic treatment of degenerative regions in the retina (obliterated smaller peripheral vessels, extensive "cystic" changes in the equatorial and peripheral retina, and so forth) is easily and safely accomplished by light coagulation.

It is our purpose on this occasion to discuss the effect of and to review our experiences with the use of light coagulation performed either at the time of retinal detachment surgery or at some later date during convalescence.

Although it appears that the use of photocoagulation rather than electrodiathermy at the time of surgery would be ideal, there are several factors which frequently contradict this assumption. In the first place, the retina may not be in complete contact with the pigment epithelium and the choroid in spite of the previous drainage of subretinal fluid. A very thin film of subretinal fluid may remain, difficult to recognize ophthalmoscopically and hazardous to remove surgically. Under these circumstances, light coagulation very likely will produce little if any lasting chorioretinal adhesion, whereas electrodiathermy produces a better and longer lasting exudate that will still be "fresh" when the two membranes become apposed several days after surgery.

Another difficulty with the use of light coagulation at the time of surgery is the fact that the cornea often has become hazy in spite of the many well-known methods to avoid corneal edema. Of course, the corneal epithelium can be removed (and we have no compunctions for having done this), but the corneal stroma may also be a little hazy, frustrating one's attempts to perform adequate photocoagulation.

Although light coagulation can be performed far out into the periphery of the retina, there are some breaks that are incompletely surrounded because of their anterior location or by the fact that the equatorial regions of the lens may cause a scattering of the light rays, thus reducing their effectiveness. Under these circumstances, electrodiathermy around the break is preferable, ensuring a firm band of adhesions at the anterior base of the break as well as at the central margins of the break.

With the greatly increased use of scleral resection, scleral buckling, and encircling plastic tube or rod operations, another complication in the use of photocoagulation at the time of surgery is introduced. If the break in the retina is directly over the crest of the buckle, it is often amenable to light coagulation; this is most true if the buckle is in the form of a gradual roll rather than in a sharp crease. In the latter case the break is often considerably distorted and the choroid frequently is not capable of producing much exudate. Very often, the break is not on the crest of the buckle, but either anterior or posterior to it. If the buckle is formed by a plastic tube or rod, it may be adjusted to the new locale, but lamellar scleral resections and infoldings cannot be altered easily in this manner. If the

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break is well anterior to the scleral resection, photocoagulation can be performed adequately in many instances. If the break is just central to the resection, however, the infolding may overhang the break which is then inaccessible to the beam of light. In these instances, electrodiathermy is much more easily and effectively employed at the time of surgery.

An important situation in which light coagulation is of great help is the following:

An unfortunate anatomic fact is that there is always a vortex vein underlying the insertion of the superior oblique muscle. Another disagreeable fact is that very often the retinal tear to be surrounded lies in such a position that the encircling electrodiathermy runs dangerously close to the ampulla of this vortex vein. If at the close of surgery the retinal tear in this situation is flat, one may more safely finish the encirclement of the tear with photocoagulation than with diathermy, thus reducing the risk of a severe hemorrhage.

Because of the several reasons just mentioned, we do not routinely use photocoagulation at the time of detachment surgery. Inasmuch as the globe is already exposed to obtain subretinal drainage or to perform one or another type of scleral operation, we prefer to utilize partially penetrating electrodiathermy at the same time. However, our photocoagulation machine is located close at hand across the hall from the recovery room so that it can be used at any time when circumstances seem to indicate that additional light coagulation may be warranted.

Most of the time, we perform "supportive" light coagulation sometime during the patient's convalescence in the hospital from his retinal detachment surgery. This can be done satisfactorily as soon as the media are clear enough to permit good visualization by direct ophthalmoscopy. The Zeiss photocoagulation instrument is so constructed that viewing the fundus is by direct ophthalmoscopy and, unfortunately, if the vitreous is hazy enough to allow only a poor view in this manner, even a high intensity of photocoagulation will often fail to achieve good results. Under these circumstances it is wise to wait for further clearing of the media, following the patient closely by ophthalmoscopy, since too strenuous an effort to get good photocoagulation may severely damage the cornea as well as the slightly detached retina. Except in cases of infants and small children, photocoagulation is performed after a moderate amount of premedication supplemented by a topical anesthetic and often a retrobulbar injection of Novocaine or Xylocaine.

Of the postoperative conditions lending themselves to treatment by photocoagulation, the persistence of an open retinal break is the most threatening to the welfare of the eye. If the break is flat against the choroid, the prognosis with such treatment is excellent. However, if there is residual fluid under the margins of the break, or if the underlying choroid is too atrophic, or if the tear is held partly open by the crease of a scleral fold, the outlook for success with light coagulation alone is considerably reduced. Without the availability of photocoagulation in the past, we often were prompted to "sit tight" under such circumstances, and quite often the situation would improve with further spontaneous absorption of subretinal fluid and shrinkage of the scleral crease. It is more reassuring, however, to be able to place some fresh chorioretinal foci around the region by light coagulation as soon as it becomes apparent that the tear is not completely sealed.

Postoperatively, occasionally it is seen that there is an inconsistency in the amount of reaction in the protecting barrage of diathermy about the tear. In such cases, light coagulation can very easily be placed accurately to complete the containing barrage about the retinal break. In a similar fashion, we have placed a line of photocoagulation central to the fold of the scleral resection in many instances during the postoperative course. It has been our experience that often the chorioretinal scarring immediately central to a scleral resection is not as marked as desired, possibly due to the fact that the retina in this region

TABLE 1

SUMMARY OF PRIMARY CASES

	Series Y	Series Z
Number of primary cases	320	212
Cured with one operation	60.9%	61.3%
1. Diathermy	27.1%	9.9%
2. Resection	33.8%	51.4%
Cured with multiple operations	21.6%	21.7%
Total cures of primary cases	82.5%	83.0%

Series Y—patients treated before photocoagulation available.*
Series Z—patients treated after photocagulation available.†

* Period between July 1, 1955, and June 30, 1958.
† Period between July 1, 1958, and December 31, 1959.

is "tented" away from the choroid during the several days immediately following surgery.

Occasionally, one finds a new break in the retina at the time of surgery. If this break is in attached retina, we usually treat it with electrodiathermy if that portion of the sclera to be operated is already exposed. If, however, the newly found break is some distance away from the operative field, photocoagulation can be applied to this area immediately following surgery.

In a few cases we have placed photocoagulation central to an isolated pocket of elevated retina, attempting to prevent its spreading centrally. Invariably the elevation was due to an open retinal break and the photocoagulation was a temporizing measure to allow the choroid and sclera sufficient time to regain partly their consistency so as to withstand further surgery.

In some retinal detachments, in addition to the break or breaks leading to the separation, there is a hole in the macula. This is often more easily treated by first operating upon the detachment and sealing the causative breaks and then, either immediately postoperatively or very shortly afterwards, treating the region of the macular hole (if it is flat) by photocoagulation.

Another use of postoperative light coagulation is in the prophylactic treatment of unoperated portions of the retina which were not covered during surgery. It is unwise to place electrodiathermy in attached retina any more than is necessary, due to the possibility of creating new vitreoretinal adhesions or of perforating the retina. Treatment of such areas with photocoagulation has seemed to us a safer method.

Between July, 1958, and December, 1959 (tables 1 and 2), we operated upon 275 patients with retinal detachment of all types; this included idiopathic detachments, detachments due to perforating injury, detachments due to retrolental fibroplasia, detachments operated upon unsuccessfully elsewhere, and detachments with the clinical picture of vitreous retraction, using light coagulation as a postoperative adjunct in 127 of the cases (46.2 percent). Of these 127 cases, further surgery following light coagulation was necessary in 27 (21.3 percent). Of these 27 pa-

TABLE 2

SUMMARY OF SECONDARY CASES

	Series Y	Series Z
Number of secondary cases	79	63
Cured with one operation	32.9%	31.8%
1. Diathermy	3.8%	0.0%
2. Resection	29.1%	31.8%
Cured with multiple operations	11.4%	30.2%
Total cures of secondary cases	44.3%	61.9%

Series Y—treated before photocoagulation available*
Series Z—treated after photocoagulation available.†

* Period between July 1, 1955, and June 30, 1958.
† Period between July 1, 1958, and December 31, 1959.

TABLE 3

SUMMARY OF CASES CURED

	Series Y	Series Z
Primary cases cured	82.5%	83.0%
Secondary cases cured	44.3%	61.9%
Total cases cured	74.9%	78.2%

Series Y—treated before photocoagulation available*
Series Z—treated after photocoagulation available†

* Period between July 1, 1955, and June 30, 1958.
† Period between July 1, 1958, and December 31, 1959.

TABLE 4

COMPARISON OF PRIMARY CASES CURED

	X	Y	Z	Total
Number of primary cases	369	320	212	901
Cured with one operation	65.6%	60.9%	61.3%	62.6%
1. Diathermy	55.3%	27.1%	9.9%	30.8%
2. Resection	10.3%	33.8%	51.4%	31.8%
Cured with multiple operations	15.7%	21.6%	21.7%	19.7%
Total cures of primary cases	81.3%	82.5%	83.0%	82.3%

X—7/1/51 to 6/30/55: relatively few scleral resections.
Y—7/1/55 to 6/30/58: many more scleral resections.
Z—7/1/58 to 12/31/59: in conjunction with photocoagulation

tients, six were never cured by surgical means. It can be seen, therefore, that, although we used light coagulation frequently postoperatively, about one fifth of the patients receiving it required additional surgery.

It is pertinent to this subject that our experiences with another group of patients during this period of time be mentioned. In 16 patients with retinal detachment, the retina settled sufficiently with bedrest so that we felt the condition would respond to light coagulation; of these patients, the detachment recurred in eight, necessitating surgery for a permanent reattachment of the retina. It is apparent, therefore, that after retinal detachment has occurred, the effectiveness of photocoagulation is lessened, even though the retina seems to have fully returned to its proper position. As mentioned earlier, very likely there is a remaining thin film of "subretinal" fluid, and this fluid is sufficient to interfere with proper response of the choroid to photocoagulation.

Because of the many limitations placed upon it in cases of actual detachment of the retina, photocoagulation cannot be a major factor in the operative and postoperative treatment of this disease. For it to be a truly effective weapon against an existing detachment, there should be a noteworthy decrease in the number of secondary and tertiary operations necessary for a cure. We have not found that this is the case in our hands.

Tables 1, 2, and 3 contrast two successive series of patients operated upon for retinal detachment, primary cases being those which had never had previous retinal detachment surgery, and secondary cases referring to those patients who had been operated upon unsuccessfully elsewhere.

Of the patients operated upon since we have been using light coagulation, there has been little or no increase in the number of patients cured with one operation. Indeed, the only remarkable difference between the two series (Y and Z) is the improvement in the rate of cure of patients previously operated upon without success (table 2), and this apparently is due not to photocoagulation but to further operative procedures (50 percent had encircling tubes).

TABLE 5

SUMMARY OF CASES CURED

	X	Y	Z	Total
Primary cases cured	81.3%	82.5%	83.0%	82.3%
Secondary cases cured	45.1%	44.3%	61.9%	50.4%
Total cases cured	75.5%	74.9%	78.2%	76.0%

X—7/1/51 to 6/30/55: relatively few scleral resections.
Y—7/1/55 to 6/30/58: many more scleral resections
Z—7/1/58 to 12/31/59: in conjunction with photocoagulation.

The patients operated upon and reviewed in Tables 1, 2, and 3 underwent more scleral resections and encircling buckle operations than our patients operated upon previously, and it is interesting to note the comparative results in these patients (tables 4 and 5). Series X consists of patients who were seen in the latter days of "full-thickness" scleral resection and the early days of lamellar scleral resection. It is interesting to note that the patients operated upon in this period achieved a rate of cure quite similar to their fellows in the succeeding years, in spite of the fact that they were denied the several new techniques developed in the following five years.

The obvious suggestion at this point would be that the current cases being referred are more difficult, and therefore the achievement of a successful operation is less easy. Perhaps this is partially so, although it does not seem to be a significant factor. It appears more likely that many scleral operations have been performed when diathermy alone may well have sufficed. There are definite indications for the use of most of the scleral buckling procedures, and instances in which nothing short of such a procedure would cure the patient. The fact that our greatly increased use of one or another of the various scleral operations has failed to increase appreciably the rate of cure among our retinal detachment patients perhaps has lessened our disappointment in finding out that postoperative utilization of light coagulation is likewise not a "cure-all."

Summary and Conclusions

Although our experience with light coagulation in the treatment of retinal tears without detachment has been most gratifying, we have not felt that photocoagulation has helped us to any great extent in the treatment of existing retinal detachments.

It has been our habit to continue utilizing electrodiathermy at the time of surgery, rather than resorting to light coagulation, and we have found that the factors which lead to a recurrence of the retinal detachment are usually not erased by the use of light coagulation in the early postoperative course of the patient.

The development of the technique of photocoagulation by Meyer-Schwickerath is one of the most significant contributions to ophthalmology in the past 30 years. However, it must be understood, and has been mentioned by him many times, that it has limitations. The following quotation[9] is from the introductory remarks by James Hamilton Doggart in his treatise on slitlamp microscopy, and is particularly relevant to this fascinating innovation, photocoagulation:

> Students of medical history will remember how the attitude of clinicians towards some new form of investigation or treatment can fluctuate in a characteristic way. A discovery is made. Widespread enthusiasm is aroused among open-minded members of the profession. The sponsors of the discovery, who may perhaps have endured long neglect, now feel the thrill of recognition, and are inspired to foretell more benefits than the facts justify. Further extravagant claims are voiced by converts, who hail the advances as epoch-making. Time passes. Facts begin to accumulate in support of the sceptic, whose adverse remarks had at first been derided. Next comes a transitional period, during which the status of the new discovery is gradually decided by the profession. Methods without real value often melt into oblivion, but some will only suffer temporary eclipse, to be rescued by future generations lacking first-hand knowledge of their ineffectiveness. Genuine advances, however, are likely to hold some ground, in spite of opposition by former adherents dismayed at the wreckage of their expectations. Meanwhile the beneficial results of the method, such as they are, will be available for people who equally recognize its limitations and advantages.

490 Post Street (2).

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EXPERIENCES WITH A NEW PHOTOCOAGULATOR*

JAMES E. MCDONALD, M.D.
Oak Park, Illinois
AND
RANA PRATAP SINHA, M.B.
Chicago, Illinois

Since the epoch-making work of Meyer-Schwickerath[1-3] which made photocoagulation practical, some of us have felt the need for an inexpensive photocoagulator, preferably portable, which could operate on an ordinary house current.[4] There has also been a need for applied research to broaden the clinical applications of this type of therapy. Our investigations are concerned with these two needs. The degree of success and the shortcomings which we have had will be described.

Our machine utilizes a 300-watt Zirconium-enclosed concentrated arc lamp manufactured by Sylvania Electric Products Company (fig. 1).[5] This bulb requires the use of special transformers housed in a separate power box. During operation, the lamp draws 12.5 amp. at 20 volts, 2,000 volts are required for starting. The power can be obtained by plugging the machine into an ordinary 110-volt wall socket.

The light source is three mm. in diameter and has an intensity of 52 candles per square mm. or 5,200 stilbs. Average lamp life is indicated by the manufacturer to be in a neighborhood of 200 hours.

Spectral distribution of the emitted energy is mostly in the visible and infrared range (fig. 2). The optics of the apparatus are simple (fig. 3). The first condensing lens is approximately a collumnating lens and the parallel rays incident on the second lens are

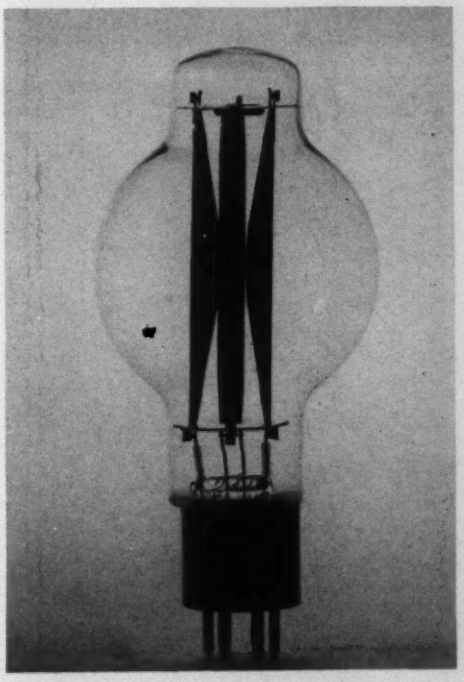

Fig. 1 (McDonald and Sinha). Zirconium-enclosed concentrated arc lamp.

* From the Department of Ophthalmology, University of Illinois, College of Medicine. Presented before the Chicago Ophthalmological Society, October 3, 1960.

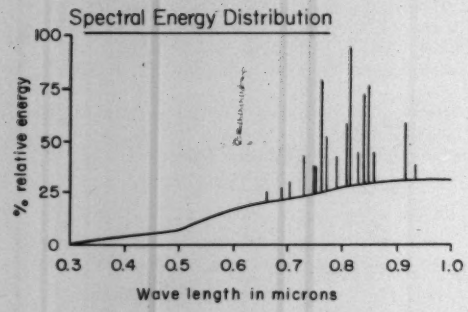

Fig. 2 (McDonald and Sinha). Data from Sylvania booklet *High Intensity Light Source.*

converged to the extent of four diopters onto a third 50-diopter conoid lens located at the nose cone of the apparatus. This lens strongly converges the rays to a small focus about two cm. from the end of the lens.

The source and lenses are housed as illustrated in Figure 4. The apparatus is designed to be suspended with two pulleys and a counter-weight and move freely in any axis and can be fixed in position by tightening the set screw. The focusing is accomplished by moving the nose cone toward the eye, five dots being seen in the target area when out of focus (fig. 5), and these converge into one when the rays are in focus on target (fig. 6). When the shutter is open the full intensity of the light is concentrated on the target area (fig. 7). The shutter is operated manually or can be used in conjunction with an electric timer and footswitch to give a measured predetermined exposure time. The diaphragm furnished with the shutter can also be utilized to reduce the size and intensity of the exposure. Dark glasses are worn by the operator and his assistant during coagulation of the iris but two pair are more satisfactory for coagulation over the conjunctiva and sclera.

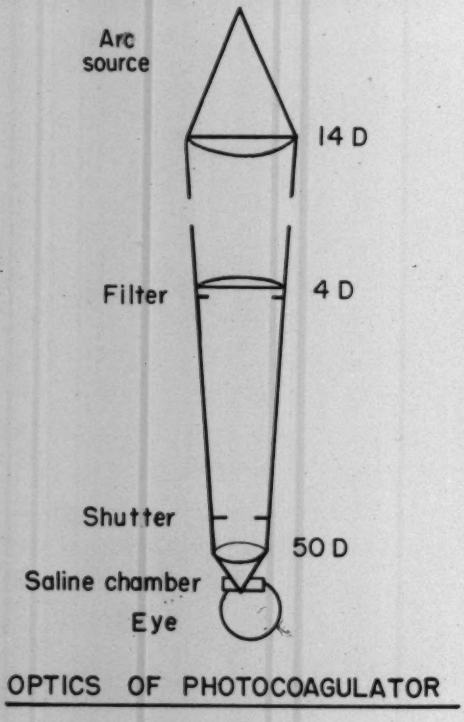

Fig. 3 (McDonald and Sinha). Optics of photocoagulator.

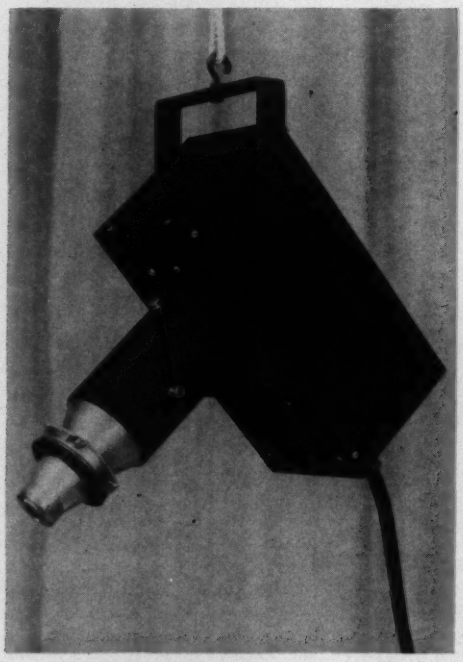

Fig. 4 (McDonald and Sinha). Coagulator in position for use.

Fig. 6 (McDonald and Sinha). In focus.

Fig. 5 (McDonald and Sinha). Out of focus.

Fig. 7 (McDonald and Sinha). Shutter open.

Fig. 8 (McDonald and Sinha). Iris coagulation 11 days postcoagulation.

Fig. 9 (McDonald and Sinha). Iris coagulation six weeks postcoagulation.

Animal experiments

Animal studies were done on more than 75 rabbits. Iris coagulation was successfully accomplished without corneal burns in 125 consecutive attempts. Coagulation of the iris requires the use of retrobulbar anesthesia and a water cooling chamber held in the eye like a contact lens. Omission of the water chamber or inadvertent leaking of this water chamber before coagulation results in an undesirable opacity of the cornea in about one half of the eyes. The iris is too sensitive to attempt its coagulation without retrobulbar anesthesia. Attempts to use 10-percent cocaine topically or 2.0-percent pontocaine or subconjunctival Novocaine proved unsuccessful.

Iris coagulation can be accomplished in rabbits in one and one-half to three seconds. Iris color, height and temperature of water in cooling chamber, texture of iris and time of exposure are factors which determine the intensity of the iris coagulation. Immediately there is an intense darkening of the rabbit iris with a depression in the radiated area (fig. 8). This results in a shrinking effect in the iris, as if one had put a purse-string suture in this area and drawn it tight. This

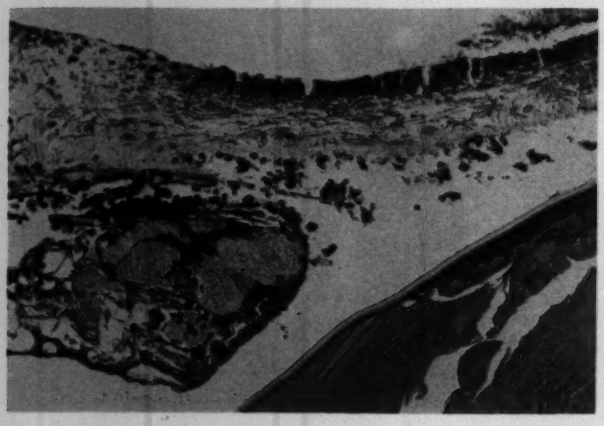

Fig. 10 (McDonald and Sinha). Iris coagulation four days postcoagulation. Atrophic iris, anterior migration of pigment and anterior subcapsular lens opacity are seen.

Fig. 11 (McDonald and Sinha). Iris coagulation six weeks postcoagulation with pupil dilated to show cataracts.

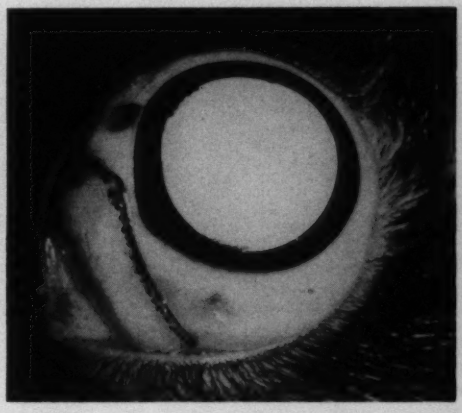

Fig. 12 (McDonald and Sinha). Transconjunctival coagulation of ciliary body.

is similar to the shrinking effect which is seen on the sclera with diathermy or in Scheie's filtering operation.

Histologically, this results in an acute inflammatory process in the iris which subsides after a few days. After one month the picture is changed in that some of the iris coagulations have perforated and all show a more atrophic appearance (fig. 9). Histology shows only iris atrophy (fig. 10).

Cataracts of varying degrees are often present under the coagulated iris area, usually in proportion to the intensity of the iris lesion (fig. 11). These have been previously described by one of us and others[1-3, 5-9] The shrinking effect on the iris is manifested by a tenting of the rabbit iris in some cases in which the pupillary margin is drawn toward the radiated area.

Transconjunctival coagulation of the ciliary body is accomplished in a rabbit in about one second with retrobulbar anesthesia and without the water cooling chamber (fig. 12). The early histology of these applications shows a partial necrosis of the sclera but without the penetration usually seen in cyclodiathermy applications. The ciliary body is seen to be temporarily inflamed (fig. 13). Subsequently it becomes atrophic in the manner of a cyclodiathermy (fig. 14). A few aberrations of the cells in the lens bow are seen in sections of some eyes and an

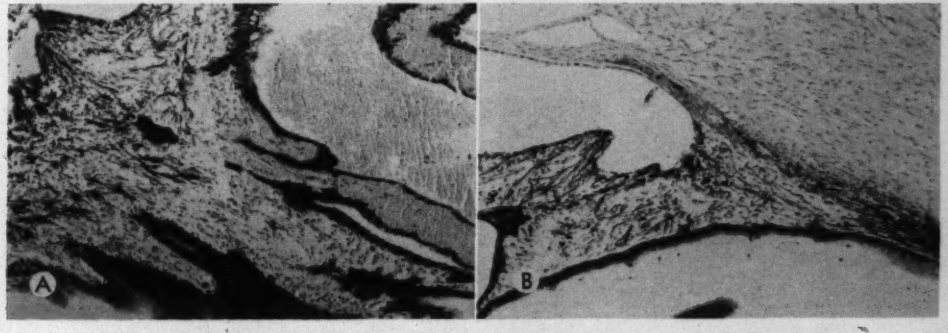

Fig. 13 (McDonald and Sinha). (A) Transconjunctival coagulation of ciliary body two days postcoagulation. (B) Control.

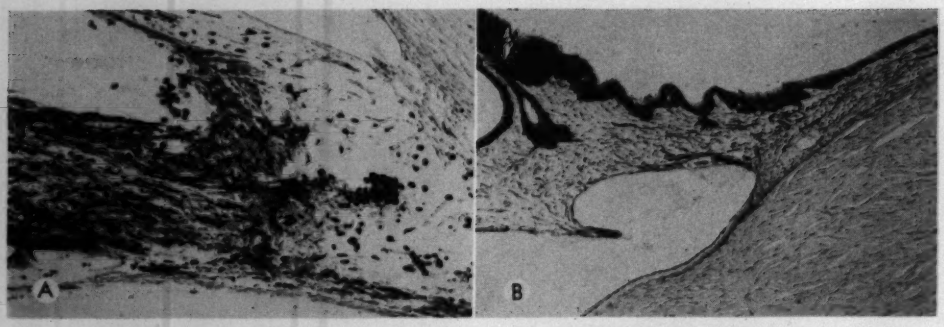

Fig. 14 (McDonald and Sinha). (A) Ciliary body five weeks postcoagulation. (B) Control.

equatorial linear opacity was noted in some after several months. With less intense therapy we expect that these opacities can be avoided. Some retinal edema in the region of the ora is also observed with this technique.

Transconjunctival coagulation of the choroid and retina is also accomplished in one to two seconds under topical pontocaine. A mild scleral darkening may result in the radiated area (fig. 15) and blanching of the retina occurred much in the manner and degree of diathermy applications or similar to the results of photocoagulation by the usual route through the pupil (fig. 16).

A technique of localization has been developed for rabbit eyes. The retina is observed through the pupil by means of the subdued light transmitted through the sclera. When the appropriate target area is seen, the shutter is opened.

The change in the choroidal pigment pattern seen while coagulation occurs results in an increased granularity of the pigment. When this area is observed by light through the pupil an ordinary snowballing of the retina is seen. Histologic examination shows an early edema of the retina which subsequently becomes atrophic (figs. 17A and B).

Fig. 15 (McDonald and Sinha). Transconjunctival coagulation of retina, postcoagulation.

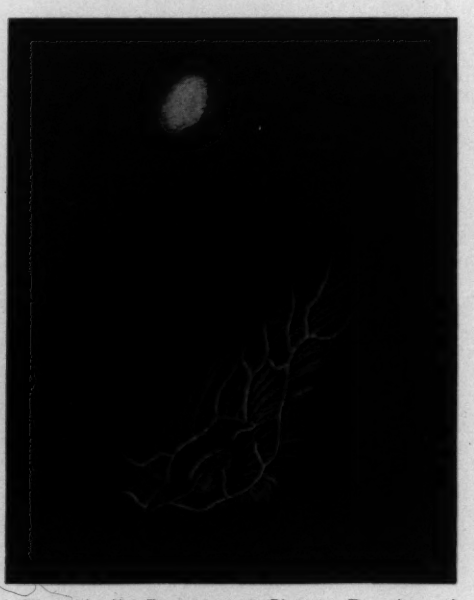

Fig. 16 (McDonald and Sinha). Drawing of fundus five minutes posttransconjunctival coagulation.

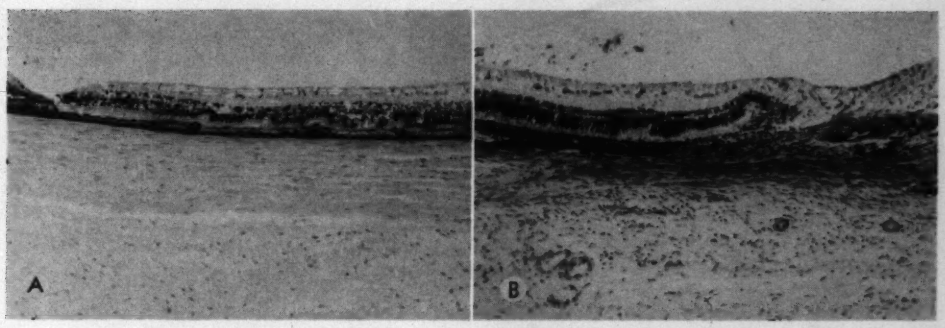

Fig. 17 (McDonald and Sinha). (A) Retina one hour posttransconjunctival coagulation. (B) Retina one month posttransconjunctival coagulation.

Because of the limitations of the intensity of the light source and the optics involved, this machine is not strong enough to coagulate the retina through the pupil in the manner of Meyer-Schwickerath.

Human experience

Experience on human patients has been limited. Fifteen patients have had coagulation to date and eight patients have had iris coagulation two months before scheduled lens extraction. These patients were followed at weekly intervals and at the time of surgery the lens and the iris lesion were removed for histologic study.

Coagulation of the human iris was not as effective as in the rabbit eyes. No through-and-through openings were produced in the two-month period of follow-up.

In brown irises, lesions were more intense and occurred with less exposure time than in the blue or gray iris. The brown iris needed two to four seconds for a good lesion, while a blue iris needed four to six seconds.

The pulling effect of iris coagulation seemed greater in the human than in the rabbit. In fact, this effect was present in some eyes without any visible iris lesion (fig. 18). Even in these, however, transillumination revealed an area of increased translucency in the coagulated area. In some eyes the coagulation effect was manifested by an immediate pulling of the iris but the coagulated area did not become visible until several weeks later when a ring of atrophy delineated the coagulation area.

One patient had an iris grossly adherent to the cornea inferiorly. Coagulation resulted in a pulling off of this anterior adhesion, as well as a pulling downward of the pupil of this area, producing a good chamber formation in this quadrant (fig. 19-A). Several weeks later the atrophic coagulated areas appeared (fig. 19-B and C). This effect was confirmed by slitlamp, as well as by gonioscopy.

No definite cataracts were produced in these eyes as a result of this treatment but

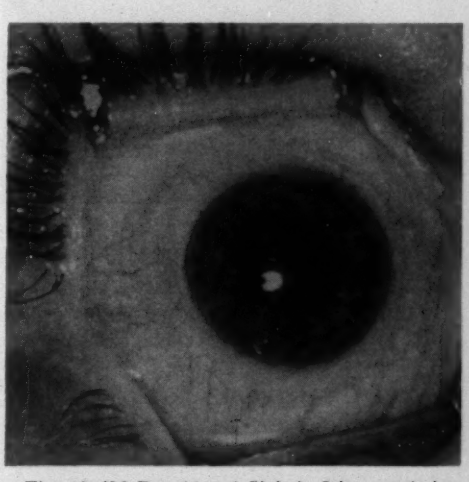

Fig. 18 (McDonald and Sinha). Iris coagulation one hour postcoagulation. Iris tenting is present without appreciable iris lesion.

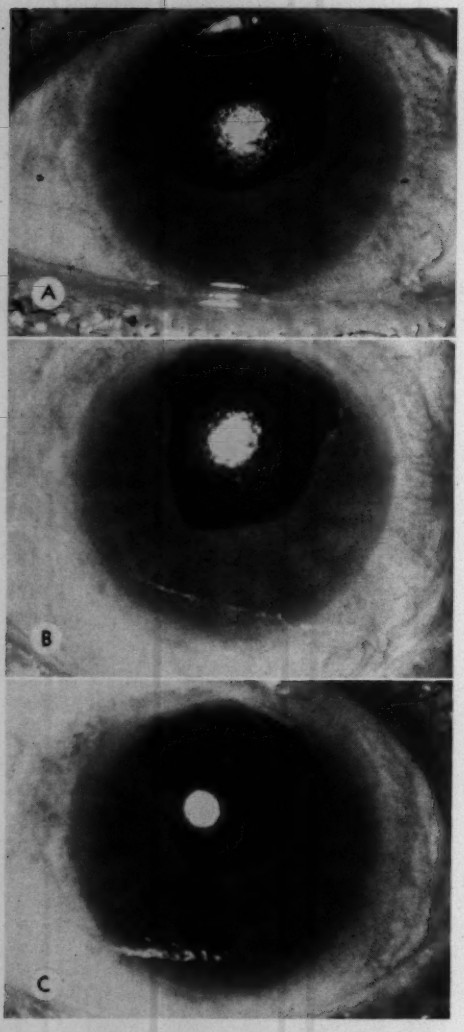

Fig. 19 (McDonald and Sinha). (A) Iris with gross peripheral anterior synechia one week after coagulation at the 4-o'clock position; before coagulation at the 7-o'clock position. (B) Same eye one hour after iris coagulation at the 7-o'clock position. Note tenting of pupillary margin. Anterior synechias were pulled off by coagulation in this quadrant. Iris lesion is almost invisible in this eye at this stage. (C) Same eye one month later. Iris lesions are darker now and surrounded by light aura making them easily visible. Increase in chamber depth in this quadrant persists.

the presence of mature cataracts prevented an assessment of lens damage in some. This may be related to the less severe iris lesions produced in humans in comparison with rabbits. Attempts to utilize the local shrinking effect of photocoagulation to increase the depth of the angle in the radiated quadrant of eyes with narrow-angle glaucoma have not yet been made.

In four human eyes the ciliary region was radiated. The pathologic alteration of these eyes was so advanced that an accurate assessment of the effect could not be made but it seemed promising. We now plan to photocoagulate less severe cases of glaucoma. Photocoagulation would seem indicated in any case which might be benefited by a cyclodiathermy type of procedure, especially those cases with cataracts or aphakia in which possible lens damage is not a factor. We believe that it should be as safe as cyclodiathermy.

We have not yet had experience in humans in the treatment of retinal holes, localized choroiditis or tumors. One would expect that bringing the heat energy in from the outside to the choroid might have advantages, especially in the treatment of localized choroiditis or tumors. In these cases the true base of the retinal pathology could be treated directly rather than by the circumferential approach as with the Meyer-Schwickerath machine. Transconjunctival photocoagulation seems to offer a nonsurgical technique for the treatment of the ciliary body, retina and choroid. Areas near the posterior pole cannot be treated without surgical intervention with this machine. Those in the periphery and extreme periphery are more easily approached.

Several xanthalasmas were treated with an exposure time of about one and one-half

seconds. The results seem comparable to those of Meyer-Schwickerath.

Summary

A new photocoagulator for external use is described; its advantages and disadvantages are outlined. Rabbit experience with iris coagulation and transconjunctival ciliary body and retinal coagulation is discussed. Experience with a limited number of human patients is described.

1853 West Polk Street (12).

Acknowledgment

We wish to thank the engineers of Multi-Electric Manufacturing Company, 4223 West Lake Street, Chicago, for their generous contribution of time and ingenuity in the development of this machine. The help of Miss H. Johnson and Miss J. Dering is gratefully acknowledged.

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THE DEVELOPMENT OF CHORIORETINAL LESIONS PRODUCED BY PHOTOCOAGULATION*

Abbott T. Kissen, Ph.D.
Wright-Patterson Air Force Base, Ohio.

William V. Delaney, Jr., M.D., and Joel Wachtel, M.D.
Columbus 10, Ohio

Introduction

The mechanics and the effects of solar chorioretinal burns have been amply documented over the past several decades. It is not within the scope of this paper to dwell upon this type of ocular lesion. It may be mentioned, however, that Meyer-Schwickerath (1956) has incorporated the basic physical principles of this phenomenon into an effective clinical instrument. Focused radiant energy, derived from an intense light source, harmlessly passes through the transparent media of the eye, producing an effect only at those sites capable of absorbing and transforming this energy into heat, that is, the pigment layers of the iris and retina. With proper control, the burn produces a mild chorioretinal inflammation which eventually develops into an adhesive chorioretinal scar.

Aside from the clinical indications for photocoagulation in the formation of a new pupil or the destruction of unwanted tissue, the instrument at our disposal is most effectively used in the creation of chorioretinal

* From the Department of Ophthalmology, Ohio State University, College of Medicine.

Fig. 1 (Kissen, et al.). Retinal lesion 15 minutes postphotocoagulation.

adhesions. When used as a method for sealing retinal holes or reinforcing diathermy reaction, therapy is followed by a period of bed rest during which the adhesion takes place. In patients, the development of the coagulation lesion can be studied only ophthalmoscopically. Fundus examination, however, offers no decisive indication of the status of chorioretinal adhesion.

Chorioretinal burns have been produced by atomic fireballs (Byrnes, 1955; Rose, 1956) and experimentally by various types of flash devices (Cogan, 1950; Ham, 1957; McDonald, 1958; and Casanovas, 1958). In the group of investigations just cited, the experiments were designed to test the effectiveness of the equipment in producing retinal burns and to appraise, generally, the histologic results.

In the present paper an attempt will be made to relate the formation of photocoagulation-induced chorioretinal adhesions to time. These data should provide a baseline for more precise photocoagulation exposures and add to our information concerning the clinical management of the patient subjected to photocoagulation.

Methods and Materials

Twenty-one adult, normal pigmented rabbits were used for photocoagulation studies. The animals were anesthetized with sodium pentobarbitol (Nembutal®), 60 mg./cc. administered intravenously. In this condition the animals are easily manipulated for alignment with the photocoagulator. Special care must be taken to maintain a moist cornea either by saline irrigation or intermittent lid closure. Maximum dilation of the pupil was achieved by use of several drops of one percent Cyclogel 20 minutes prior to, and once again immediately before photocoagulation.

A wide range of photocoagulation intensity is possible through the manipulation of various settings incorporated in the photocoagulator. These include variable voltage as well as adjustable image and iris diaphragms, which in turn, regulate, respectively, the intensity of the light source, the diameter of the retinal burn, and the percentage of light transmitted. A stepwise increase of the diaphragm opening and voltage setting (alternating with successive exposures) beginning with their minimum setting will eventually produce a "clinical burn." This type of lesion may be defined as the just-visible effect which develops slowly within a half to one second.

The clinical burns were placed in a triple band below the optic nerve. On enucleation, a suture was placed in the sclera to indicate the vertical meridian. Sections in this meridian and through the optic nerve, therefore, necessarily included photocoagulated tissue.

The animals were killed after a postphotocoagulation period ranging from 15 minutes to 28 days. After fixing the eyes in formalin for two days, the anterior segments were removed by sectioning through the region of the pars plana, leaving the retina attached at the ora serrata.

Observations

Figure 1 illustrates a portion of the retina 15 minutes postphotocoagulation. There is an obvious elevation of the retina, forming a blister and indicating the accumulation of serous fluid between the retina and the underlying pigment epithelium. A portion of the rod and cone and outer nuclear layers has been torn from its normal position in the central area of the roof of the blister.

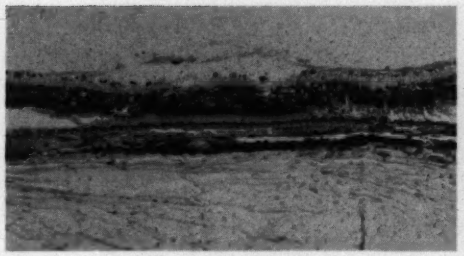

Fig. 2 (Kissen, et al.). Retinal lesion 24 hours postphotocoagulation.

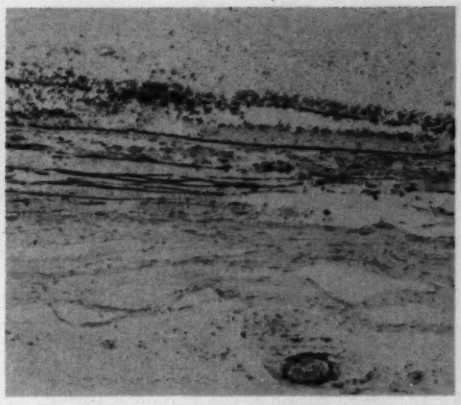

Fig. 3 (Kissen, et al.). Retinal lesion 48 hours postphotocoagulation.

The adherence of this element to the pigment epithelium is interpreted as an indication of the effects of the burn, since normal rabbit retina does not demonstrate this firm attachment. Although some disruption of all elements are visible with higher magnification, the most obvious cell damage is noted in the rod and cone layer where there is evidence of tissue fragmentation and edema. The choroid is artificially detached.

Figure 2 (24 hours postphotocoagulation) shows a blister below the internal limiting membrane. The nuclear layers appear to fuse while the outer plexiform layer shows breakdown of the fibers. There is an early migration of retinal pigment into the rod and cone layer. The choroid is hyperemic and there is clumping of choroidal pigment. It is worth noting that while the retina on either side of the burn detached during tissue preparation the retina in the photocoagulation area is firmly attached.

By 48 hours postphotocoagulation the destructive effect of the burn is evident in Figure 3. One can observe karyorrhexis of the

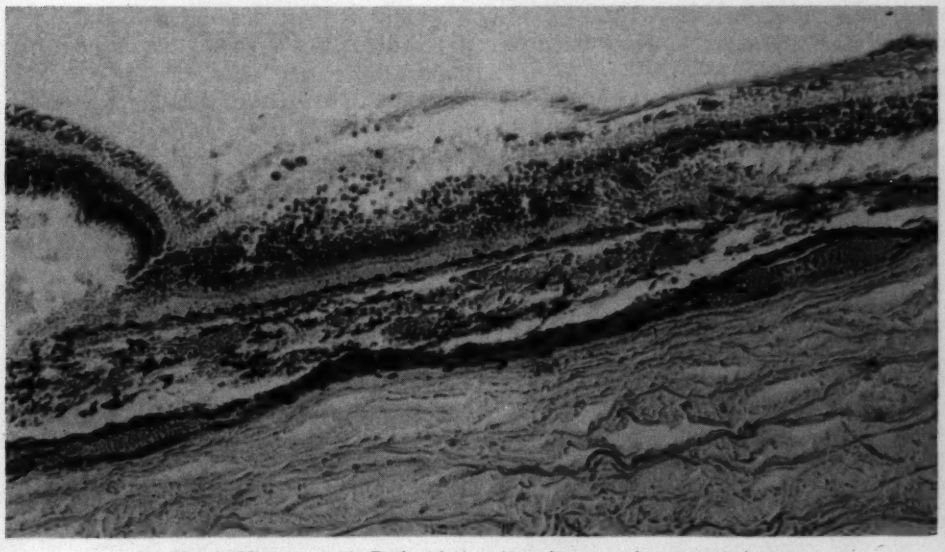

Fig. 4 (Kissen, et al.). Retinal lesion three days postphotocoagulation.

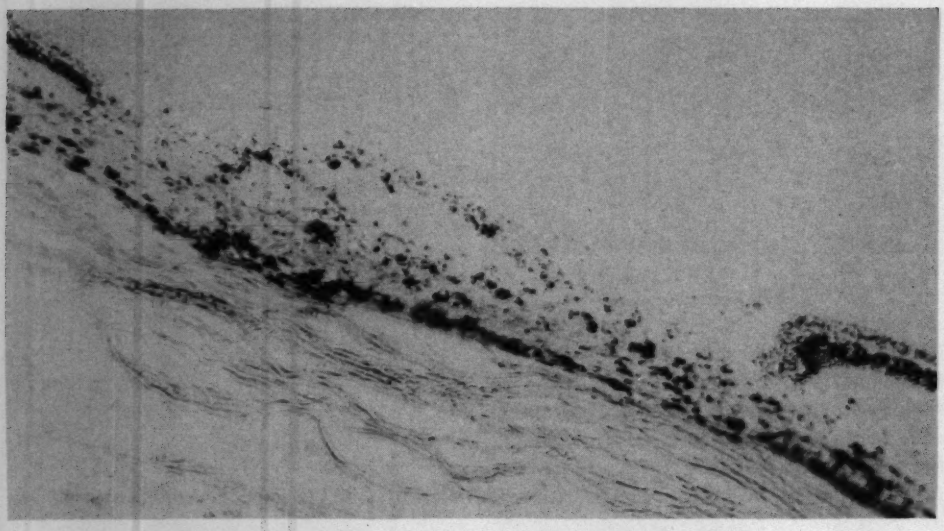

Fig. 5 (Kissen, et al.). Retinal lesion five days postphotocoagulation.

nuclei, accumulation of fibrin beneath the retina around the burn, deposition of consiberable amounts of cellular debris in the depths of the burn and many exudate-filled spaces. Inflammatory cells are rare except for an occasional lymphocyte in the choroid. The retinal pigment layer demonstrates only moderate pigment migration which is surprising since this layer probably bears the brunt of the heat.

Although the fibrin deposits are still evident in retinal lesions three days postphotocoagulation (fig. 4), retinal elements, which are still in great disarray, have begun to settle down on the choroid. There is some indication of tissue "weakness" in the border area between normal and light-coagulated retina.

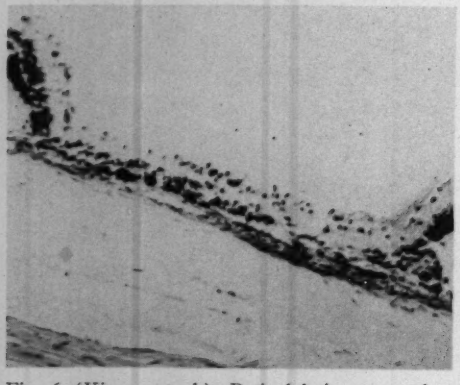

Fig. 6 (Kissen, et al.). Retinal lesion seven days postphotocoagulation.

Figure 5 illustrates the well-established reparative process within the five-day-old lesion. Scavenger cells are in the area phagocytizing destroyed nuclei and scattered pigment. Retinal architecture is no longer definable and choroidal fibroblasts have filled the defect, drawing the edges of the retina down into the scar.

The "clinical burn" is well healed by the seventh day postphotocoagulation (fig. 6). Choroidal fibroblastic proliferation has produced a tight adhesion between the retina and the choroid. Microtechnique processing has detached the retina with the exception of the coagulated area. With higher magnification it is possible to see infiltrate of fibrous tissue in the retinal area which contains scattered clumps of pigment and which is continuous with a similar choroidal infiltrate.

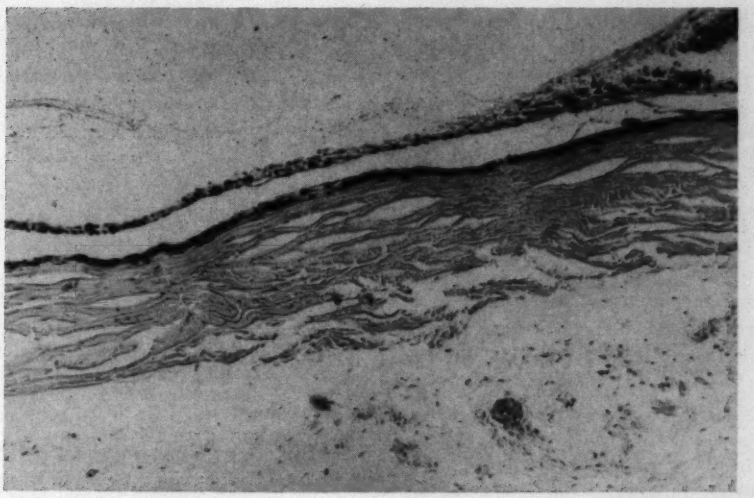

Fig. 7 (Kissen, et al.). Retinal lesion nine days postphotocoagulation.

Figures 7 and 8 illustrate the appearance of the lesions, nine and 17 days postcoagulation, respectively. There is essentially no histologic change taking place during this period. In either case only a thin line of fibrous tissue remains, filling the defect of the burn.

Discussion

The effect of photocoagulation appears to be the production of heat in the pigmented layers of the retina and choroid followed immediately by the formation of a blister which temporarily detaches the retina in the area of coagulation. Within 24 hours there is a general disruption of retinal elements and proliferation of retinal pigment epithelium in the burn area. Fibrin accumulates and the disturbed retinal elements disintegrate and are phagocytized. By the fifth day after light coagulation a reparative process is well established and choroidal fibroblastic proliferation is evident. Few inflammatory cells are seen. A tight chorioretinal adhesion is present by the seventh day although reparative changes are still evident nine days postcoagulation. Conclusions as to the strength of the chorioretinal adhesion are only speculative; however, it is probable that the union would not be disrupted by move-

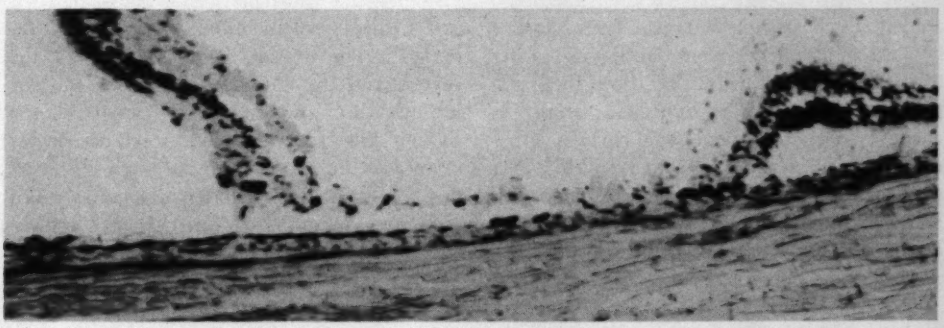

Fig. 8 (Kissen, et al.). Retinal lesion 17 days postphotocoagulation.

ment of the patient by the fifth day, depending upon the severity of the burn. Heavier burns destroy the tissue rapidly and at their margins normal retina frequently was seen to tear away in processing.

Summary

1. Light coagulation is an effective method of achieving sharply localized chorioretinal adhesions.

2. Where the intensity of the light source is neither too weak nor too intense our observations indicate that a tight chorioretinal adhesion is achieved by the fifth day following coagulation.

3. A sufficiently severe chorioretinal burn can undoubtedly destroy the target tissue, to the point of actually weakening the area sought to seal.

Aerospace Medical Division.
Department of Ophthalmology (10).

Acknowledgment

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DIFFERENTIAL DIAGNOSIS OF THE SHORTENED ANGLE

Herve M. Byron, M.D.
Elmhurst, New York

Gonioscopy plays an increasingly important role in the diagnosis of ocular diseases. In 1957, Kessler described the type of angle which Gorin recently named the "shortened angle." Such an angle results from closure beginning at its periphery and progressing toward the line of Schwalbe. Both these authors attributed the shortened angle to chronic noncongestive angle-closure glaucoma. That at least two other conditions, accompanied or unaccompanied by increased intraocular pressure, may produce a localized gonioscopic appearance of the shortened angle will be demonstrated.

To classify an angle as open, the entire width of the trabecular zone including the scleral spur must be visualized. Occasionally an angle is open to drainage but the observer cannot see over the last roll of the iris to visualize the trabecular meshwork. In such cases, displacement of the focal lines reflected from the posterior surface of the cornea and the anterior surface of the iris implies that an open angle exists. Even though the trabecular meshwork is clearly delineated in some cases, the angle is classified as shortened when no displacement of these two focal lines is seen. Figure 1 illustrates the open angle, the closed angle and the shortened angle.

After reading about this type of angle, I detected this gonioscopic appearance while

examining four patients. Two of the four patients exhibited coloboma of the lens and the other two exhibited a subluxated lens.

Report of cases

Case 1

W. K., a 42-year-old white man, was first seen in the clinic of J. Gordon Cole, M.D., at the New York Eye and Ear Infirmary in 1954 for treatment of a conjunctivitis, O.U. He was not seen again until 1958, at which time a manifest refraction was performed. He was given: R.E., −7.0D. cyl. ax. 1650, 20/40; L.E., −3.0D. sph. ⊃ −5.0D. cyl. ax. 15°, 20/70.

The patient next came to the infirmary on February 17, 1960, complaining of pain around the right orbit for the previous two weeks. Examination of the patient at this time revealed intraocular pressure of 20 mm. Hg, R.E., 24 mm. Hg, L.E., and bilateral inferior iridodonesis. A resident physician tentatively diagnosed the condition as bilateral subluxated lenses with secondary glaucoma. Water drinking test, perimetry and tonography were ordered.

The water drinking test was positive in his left eye. Central and peripheral fields were normal, O.U., as were the size of his blindspots. The results of the tonography were: O.D., T = 19, c = 0.19, K = 1.80, $P_o/c = 95$; O.S., T = 21, c = 0.13, K = 1.43, $P_o/c = 161$. Gonioscopy showed the angles to be open, O.U., with no synechias, but shortened inferiorly in both eyes. No change had taken place in his refractive or visual status.

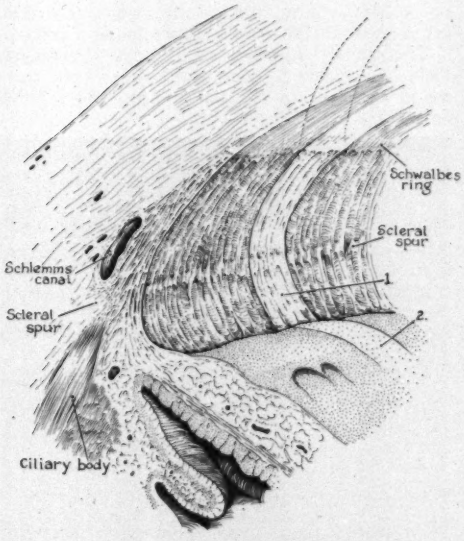

Fig. 1A (Byron). The gonioscopic appearance of the open angle. (1) The focal line reflected from the posterior surface of the cornea. (2) The focal line reflected from the anterior surface of the iris. Notice the separation of these focal lines at their junction in the open angle.

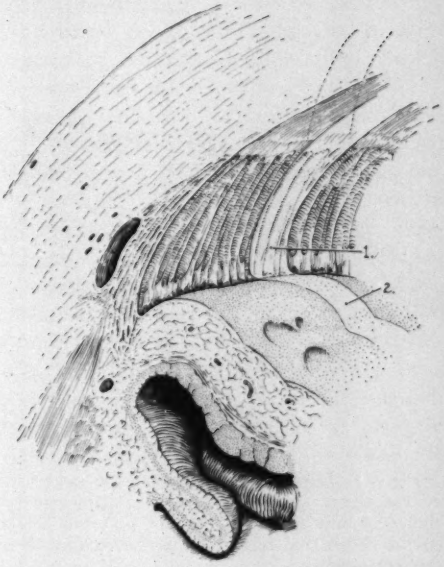

Fig. 1B (Byron). The goniscopic appearance of the shortened angle. (1) and (2) represent the same focal lines. Notice the absence of any separation at their junction in this anatomic situation.

After a carbonic anhydrase inhibitor was given orally, his pupils were dilated, O.U. Bilateral inferior colobomas of his lenses were noted. The coloboma in his right eye is shown in Figure 2.

The patient was given pilocarpine (0.5 percent) to use twice a day in each eye. He returned in one week, at which time the tension was 15.6 mm. Hg, O.D., and 21.9 mm. Hg, O.S. He was instructed to use the medication once a day in each eye. One week later, the tension was 18.5 mm. Hg, O.U. He is being maintained on this regimen.

The patient's three children were examined completely. None of the three showed any coloboma of the lens.

Case 2

R. V., a 28-year-old white man, the son of the sister of the patient in Case 1, came to Dr. J. Gordon Cole's clinic at the New York Eye and Ear Infirmary in April, 1960, as a subject in the study of this particular family. He had been told by Army physicians in 1954 that he had "something wrong with his eyes." The patient was asymptomatic.

Examination of the patient revealed a visual acuity of 20/50, O.U., without any corrective

Fig. 1C (Byron). The gonioscopic appearance of the closed angle. (1) and (2) again represent the focal lines reflected from the posterior surface of the cornea and from the anterior surface of the iris respectively.

lenses. With a −5.5D sph. ⌒ +4.0D. cyl. ax. 90°, R.E., 20/40; −1.5D. sph., L.E., 20/20. Bilateral inferior iridodonesis was noted in this patient, more marked in the right than in the left eye.

Gonioscopy showed open angles, O.U., with pigment strands from the cornea to the iris throughout the entire circumference of the angles, O.U. In addition, the inferior part of the angle, O.D., was shortened. His intraocular pressure was 18.5 mm., Hg, O.D.; 14 mm. Hg, O.S. The patient's pupils were dilated for examination.

Funduscopy revealed an inferior coloboma of his right lens, as shown in Figure 3. He also had a slight coloboma in his left lens. The remainder of the funduscopic examination was normal. Central and peripheral fields and blindspots were normal, O.U.

Tonography was also done on this patient. The results were: O.D., $T = 17$, $c = 0.22$, $K = 1.61$, $P_o/c = 77$; O.S., $T = 14$, $c = 0.26$, $K = 1.04$ $P_o/c = 54$. The patient will be checked again in six months.

CASE 3

L. G., a 61-year-old white man, was first seen in Dr. Joseph H. Krug's clinic at the New York Eye and Ear Infirmary in July, 1958, complaining of failing vision in his left eye for the previous seven months. A steamy cornea, subluxated lens and intraocular pressure of more than 75 mm. Hg were found on examination of this eye. No gonioscopic examination was performed.

The patient was admitted to the hospital and a combined iridectomy and intracapsular extraction of the subluxated lens were performed two days later. On the third postoperative day, an iris prolapse and hyphema were detected in the operated eye. These were repaired on the same day. At the time of his discharge from the hospital, the anterior chamber was clear and he could count fingers at two feet, O.S., without an aphakic lens. When he was refracted in October, he accepted a +1.5D. cyl. ax. 180°, O.D., 20/40; +10.5D. sph. ⌒ +2.5D. cyl. ax. 10°, 20/20—4 in his operated left eye.

The patient returned to the clinic on February 4, 1960. At this time he complained of halos and tearing in his right eye for the previous two months.

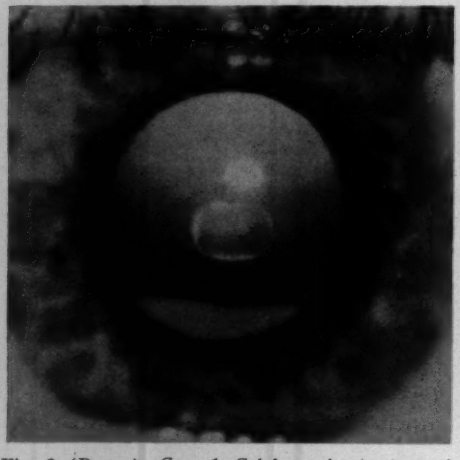

Fig. 2 (Byron). *Case 1.* Coloboma in the lens of the right eye.

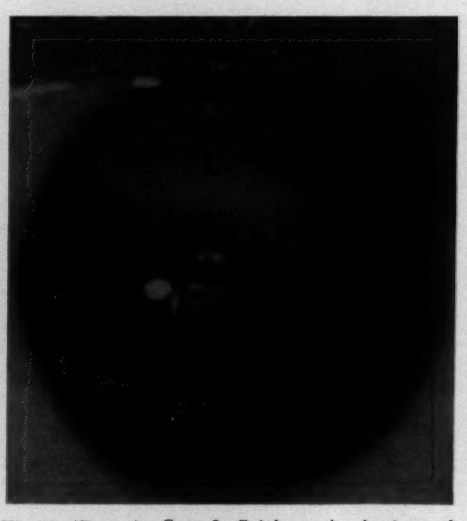

Fig. 3 (Byron). *Case 2.* Coloboma in the lens of the right eye.

Examination, O.D., revealed vision of 20/50+2 without correction, temporal iris atrophy, superior iridodonesis and a subluxated lens superiorly. Gonioscopy showed an angle shortened superiorly and open inferiorly, with strands of iris tissue seen around the circumference of the angle extending to the cornea. His intraocular pressure was 35.8 mm. Hg, O.D.; 18.5 mm. Hg, O.S.

Five days later the patient was admitted to the infirmary, where a combined basal iridectomy and intracapsular cataract extraction were performed on his right eye without loss of vitreous. Except for mild hyperemia of his conjunctiva, which persisted for several weeks postoperatively, no complications were noted. In March, the patient was refracted. With his aphakic lens, he could see 20/25—2 with this right eye. The intraocular pressure, O.D., at the time was 15.6 mm. Hg.

On April 5, 1960, the patient returned to the clinic complaining of brightness of all lights. The tension in his right eye was now 33 mm. Hg. Gonioscopy at this examination revealed an angle closed superiorly, with some broad-based synechias present inferiorly. He was given pilocarpine (0.5 percent) to use three times a day in his right eye.

Tonography performed eight days after the patient started using this mediation showed: O.D., $T = 59$, $c = 0.105$. $K = 5.14$, $P_o/c = 561$; O.S., $T = 23$, $c = 0.28$, $K = 3.64$, $P_o/c = 82+$. He was instructed to use pilocarine (4.0 percent) four times daily, O.U. He has been seen several times in the out-patient clinic since then and the intraocular pressure in his right eye has gradually been decreased with the aid of carbonic anhydrase inhibitors.

CASE 4

A. K., a 59-year-old white woman, the private patient of Virginia Lubkin, M.D., came to the New York Eye and Ear Infirmary to undergo an operation for a subluxated cataractous lens in her left eye.

Preoperative gonioscopic examination of her left eye revealed a superiorly subluxated lens, iridodonesis superiorly, a shortened angle superiorly and a wide open angle inferiorly. The patient's history showed that the left eye had been amblyopic since childhood. The intraocular pressure was 15.6 mm. Hg, O.U.

The day after admission to the hospital, a combined iridectomy and intracapsular cataract extraction (by means of a loop) were performed by Dr. Lubkin without loss of vitreous. The postoperative course has thus far been uneventful (six months). Her intraocular pressure has remained within normal limits, O.U. She has been fitted with a corneal contact lens for the operated eye, which has regained some vision.

DISCUSSION

These four case reports are presented in an attempt to show that the localized gonioscopic appearance of a shortened angle may result from coloboma of the lens or subluxation of the lens, in addition to chronic noncongestive angle-closure glaucoma.

The patient in Case 1 demonstrated bilateral colobomas inferiorly of almost equal size and chronic simple open-angle glaucoma. The existence of glaucoma in this patient was probably a coincidental finding unrelated to the colobomas of his lenses. That the shortening of the angle in the area of the coloboma was due to the coloboma and not to chronic noncongestive angle-closure glaucoma is inferred from the existence of a wide open angle of normal depth throughout the remaining circumference of the angle. In addition, neither Duke-Elder nor Mann cite any relationship between coloboma of the lens and glaucoma.

As in the case of his uncle's eyes, the patient in Case 2 demonstrated the gonioscopic criteria of a shortened angle only in the area of his coloboma. This finding would seem to verify the concept that the shortened angle is a diagnostic sign of coloboma of the lens in addition to chronic noncongestive angle-closure glaucoma.

Patient 3 experienced a subluxated cataract with secondary glaucoma in both eyes. A shortened angle was seen gonioscopically only in the area of the subluxated lenses; the remainder of the angle was open. It would appear that the increased intraocular pressure in his left eye was secondary to the subluxated lens, since extraction of this lens has thus far normalized the tension. Tonography has verified this assumption. However, the glaucoma in his right eye does not seem to be secondarily related to the subluxation but rather to be chronic noncongestive angle-closure in type. The early postoperative normalization of the tension in his right eye was due to the usual suppression of aqueous production at this time. Subsequent elevation of the tension in his right eye, the results of tonography and the gonioscopic appearance of his angle all speak for the coincidental existence of primary glaucoma.

Despite this conclusion, the appearance of a shortened angle superiorly in his right eye preoperatively can be attributed to the subluxated lens and not to the independent existence of primary glaucoma. This is inferred from the wide-open appearance of the remainder of his angle and from the clinical picture of Patient 4. This patient presented the same shortened angle gonioscopically only in the area of her subluxated lens but has not to date manifested any signs of either primary or secondary glaucoma postoperatively. Therefore, the shortened angle may perhaps be considered a diagnostic sign of subluxation of the lens in addition to coloboma of the lens and chronic noncongestive angle-closure glaucoma.

Kessler and Gorin have both described the mechanisms responsible for the different types of angle-closure glaucoma.

In 1956, Kessler pointed out that two factors, namely, the resistance of the tissue of the peripheral part of the iris and the pressure in front of this part of the iris, are responsible for keeping the angle open. He enumerated, in 1957, the factors which determine the normal form of the iris: the properties of its tissue, the action of its muscles, the forces acting on its surfaces, the volume and position of the ciliary body which affects the root of the iris, and the position of the anterior surface of the lens. In this same article, he described a pertinent concept relating to the properties of iris tissue:

> The tissues of the eye are damaged progressively and undergo progressive atrophy. Atrophic tissue is less resistant to the forces acting on it. Since it has lost its normal resiliency, it is distended by them, that is, it loses its ability to regain the primary form. The peripheral iris becomes progressively distended, loses its resiliency like the atrophic wall of a varicose vein and may form a rather sac-like protrusion.

Based on these ideas, the following theory is offered to explain why coloboma and subluxation of the lens may result in the gonioscopic appearance of a shortened angle.

It may be postulated that, in these eyes, decreased resistance of the peripheral part of the iris exists in the affected area. In the case of coloboma, Mann points out that this anomaly is usually associated with abnormalities of the iris. Even though such abnormalities were not grossly visible, it seems plausible to assume that microscopic abnormalities were present. In the case of subluxation (which in the two patients reported herein was unrelated to trauma), it is similarly plausible to envision microscopic anomalies of the peripheral part of the iris at the site of dislocation. Furthermore, the lack of lens substance in coloboma and the anomalous position of the lens in subluxation, resulting in lack of lens substance at this site, certainly alter the pressure in front of this part of the iris and disturb the forces acting on it. Thus, it would appear that, in these two conditions, the iris may protrude at its base, causing a shortened angle partially because of lack of peripheral resistance and altered anatomic relationships in front of it.

The position of the ciliary body, which influences the root of the iris, is the third factor explaining the shortened angle in these two conditions. Mann points out that, in the area of the coloboma, an anomalous condition of the fibers of the suspensory ligament exists. They may be either entirely absent or thinned at the notch. A similar condition must develop, although not necessarily congenitally, in atraumatic subluxation of the lens. Duke-Elder states that ectopia lentis and coloboma frequently occur simultaneously, due to the pathologic condition of the suspensory ligament. It would appear that the finding of a shortened angle in these two particular conditions is not wholly accidental and unrelated. Due to the pathologic alteration of the suspensory ligament, the ciliary body is malpositioned at this site, further upsetting the normal relationship and position of the iris.

In conclusion, it should be emphasized that, before the shortened angle is unequivocally attributed to glaucoma, a thorough study should be made of the entire circum-

ference of the angle and of the morphology and position of the lens. When the gonioscopic appearance of the shortened angle exists throughout the entire circumference of the angle, the existence of any condition other than chronic noncongestive angle-closure glaucoma is rather remote.

Summary

Four case reports are presented to demonstrate that the localized shortened anterior chamber angle may be caused by coloboma and/or subluxation of the lens. Of two patients who displayed coloboma of the lens, one coincidentally showed chronic simple glaucoma. Of two patients exhibiting subluxated lenses, one showed chronic noncongestive angle-closure glaucoma.

The reasons for attributing the gonioscopic appearance of shortened angles in these patients to the colobomas and subluxation of their lenses are discussed.

A suggested pathogenesis for the gonioscopic appearance of shortening of the angle in these two conditions is presented.

It is emphasized that, in patients exhibiting a shortened angle, a thorough examination of the entire circumfercence of the angle and of the morphology and position of the lens be made in order to diagnose the underlying cause more accurately.

80-31 Broadway.

I should like to thank Drs. J. Gordon Cole, Joseph H. Krug and Virginia Lubkin for their permission to report these cases and for their help in preparing this paper. Dr. Seymour Fradin was kind enough to draw Figure 1. The author is now with the Department of Ophthalmology, New York Medical College.

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THE ROSETTES OF A NEURO-EPITHELIOMATOUS RETINOBLASTOMA*

J. Reimer Wolter, M.D.
Ann Arbor, Michigan

Many eye pathologists still differentiate three types of neuroectodermal tumors of the retina: retinoblastoma, neuro-epithelioma, and true glioma (astrocytoma). Histologically this differentiation is made by the fact that retinoblastomas are composed of very undifferentiated cells which usually show endophytic growth, lobular arrangement of the cells around blood vessels, and intervascular necrosis and calcification. Neuro-epitheliomas, in contrast, are histologically recognized by exophytic growth and the existence of Flexner-Wintersteiner rosettes. Both of these tumors are commonly seen. The true glioma (astrocytoma), however, is rare. Parkhill and Benedict[1] have found that the prognosis is better in neuro-epithelioma as compared to retinoblastoma. True glioma are quite different from retinoblastoma and neuro-epithelioma; they are only locally malignant (McLean[2]).

In a recent study, Herm and Heath[3] pointed out that neuro-epithelioma and ret-

* From the Department of Ophthalmic Surgery and the Laboratory of Neuropathology of the University of Michigan Medical Center. This study was supported by Grant No. B-2873 of the U. S. Department of Health, Education, and Welfare.

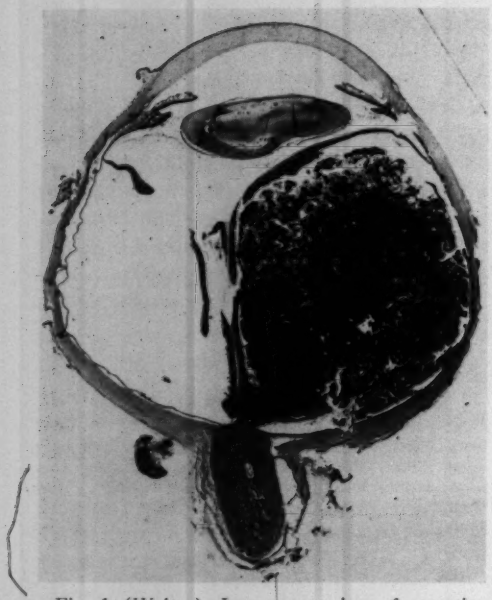

Fig. 1 (Wolter). Low-power view of a section of the eye with the exophytic neuro-epitheliomatous retinoblastoma. The detached retina is seen to cover the tumor completely. (Hematoxylin-eosin, photomicrograph.).

inoblastoma probably represent just different stages of the same retinal tumor. They consider retinoblastoma the later and more undifferentiated stage of neuro-epithelioma. Thus, the higher mortality found in retinoblastoma as compared to neuro-epithelioma may be explained by the more advanced dedifferentiation. The fact that large areas of most neuro-epitheliomas contain no rosettes and show the histologic features of retinoblastoma is used by Herm and Heath[3] as further evidence for their view. The latter fact has already been emphasized by Reese[4] who used the term "neuro-epitheliomatous type of retinoblastoma" for the tumor with rosettes. Another common way for the eye pathologist to classify the two tumors and to emphasize their close relation is simply to call them retinoblastoma with rosettes and retinoblastoma without rosettes. Of these the ones with rosettes may be given a slightly better prognosis.

For completeness of this brief introduction it may be mentioned that the medullo-epitheliomas of the pars ciliaris retinae represent a fourth main group of neuro-ectodermal retinal tumors; but they are much more differentiated and therefore much less malignant (Fralick and Wilder,[5] Wolter and James[6]).

In the present paper a case is demonstrated which exhibits the characteristics of a neuro-epitheliomatous retinoblastoma: exophytic growth, and very large and extremely well differentiated rosettes. Special attention is given to these unusual rosettes.

Case history

This four-month-old boy was seen by Dr. L. Keith Gates of Logan, Utah, in June, 1960. The mother had observed a white reflex from the pupil of the left eye. Dr. Gates found a high retinal detachment caused by a large tumor in the left eye. Another small retinal tumor was seen in the right eye. The family history was negative. Dr. Gates made the diagnosis of a bilateral retinoblastoma and did an enucleation of the left eye with the large tumor June 8, 1960. This eye was sent to this Eye Pathology Laboratory for histologic examination.

Histologic findings. The globe measured 20 by 20 by 19 mm. The anterior portion of the eye was normal. The retina was totally detached and a large white tumor of loose consistency was seen on the temporal side under the detached retina.

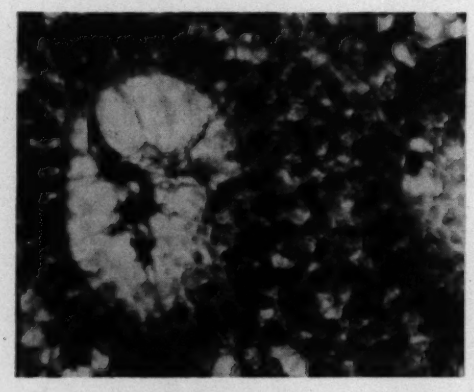

Fig. 2 (Wolter). High-power view of a rosette after hematoxylin-eosin stain. Star-shaped cells with small round nuclei are seen in the lumen of the rosette. Part of another rosette is seen on the right. (Hematoxylin-eosin, photomicrograph.)

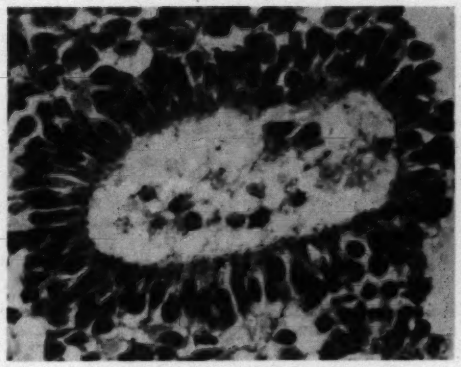

Fig. 3 (Wolter). High-power view of a large rosette measuring more than 100 micron in diameter after Hortega stain. The cell bodies and inner footplates are well visible. Star-shaped cells with round nuclei are seen in the lumen. (Hortega stain, photomicrograph.)

Macroscopically no extension of the tumor beyond the eye was seen.

The histologic examination also showed the anterior part of the eye to be normal. The retina was totally detached and showed early degeneration. Temporally a very cellular tumor was attached to the outer retina involving the outer retinal layers and filling the whole retroretinal space (fig. 1). No extensions of the tumor into the choroid, the sclera, or the optic disc were found. In its periphery this tumor contained many rosettes. In the center it was of more undifferentiated cytology and here it exhibited lobular growth around blood vessels as well as interlobular necrosis and areas of early calcification.

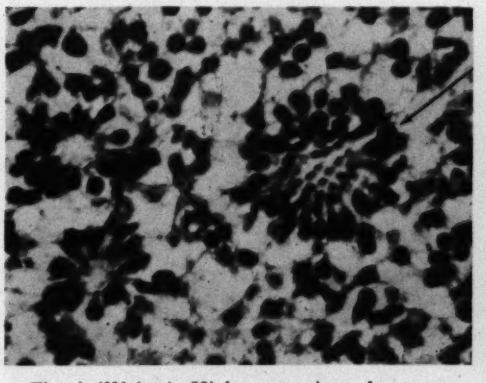

Fig. 4 (Wolter). High-power view of a tangential section through the wall of a rosette (arrow). The section shows the footplates cut across in the center. Three small rosettes are seen left. (Hortega stain, photomicrograph.)

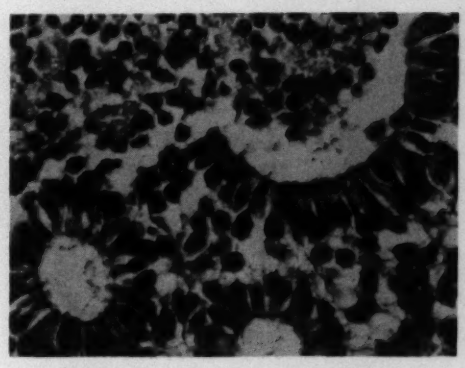

Fig. 5 (Wolter). Rosettes at the margin of an area of necrosis. A part of the large rosette in the upper right corner has been destroyed while the other part has survived. (Hortega stain, photomicrograph.)

The rosettes in this case at once appeared unusual because of their size, shape, and cytology. Silver carbonate stains[7] were done in addition to routine hematoxylin-eosin sections to gain more insight into the structure and cytology of the rosettes.

The rosettes seen in this tumor are very large. The largest ones measure about 100 micron in diameter (fig. 3). Figure 2 is an example of a larger rosette as seen after hematoxylin-eosin stain. The cells of the rosette and the cuticular inner membrane are clearly seen. Furthermore, some star-shaped cells with round nuclei are shown in the lumen of this rosette. Similar cells in the lumen of rosettes as seen after silver carbonate stain are seen in Figure 3. Not all the rosettes in this tumor are large. All sizes are seen from the usual small rosettes (figs. 4 and 7) to the giant

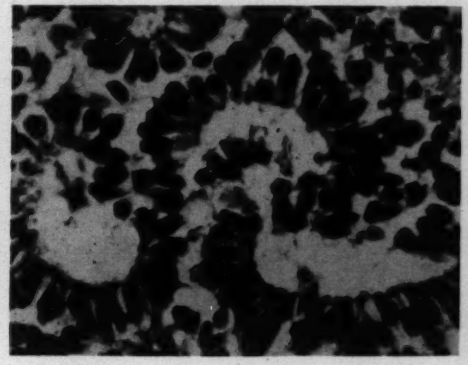

Fig. 6 (Wolter). Complicated formation of three incomplete rosettes. These three rosettes seem to have disturbed each other in their development. (Hortega stain, photomicrograph.)

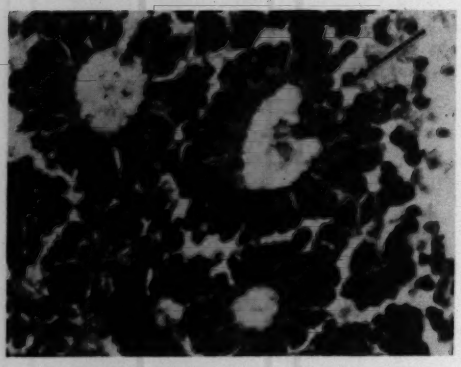

Fig. 7 (Wolter). Four rosettes one of which (arrow) shows indentation in one area of its wall. (Hortega stain, photomicrograph.)

rosettes. Serial sections stained with hematoxylin-eosin were used in this case to reconstruct the shape of the rosettes. Virtually all of them represent spherical or slightly oval vesiclelike formations.

Small rosettes are surrounded by one layer of epithelioid cells with their nuclei in one circular row. The large rosettes are often seen to form more than one row of cells in their wall. Figures 3 and 8 clearly show the cytology of the wall of large rosettes in this case. All cells have footlike inner processes extending to the lumen of the rosettes. With their inner end they form the inner cuticular membrane by joining in a mosaiclike arrangement. This can be studied by tangential sections through the wall of rosettes (fig. 4). In the large rosettes the cells are so crowded that their nuclei do not find space to be arranged in one row. This results in a more complicated and somewhat retinalike appearance of the larger rosettes (figs. 3 and 8). In the small rosettes the cells are much less crowded (figs. 4 and 5).

Rosettes may be found at the margin of areas of necrosis. They are not always destroyed as a whole. Parts of them may survive in their old arrangement (fig. 5).

Not all rosettes are perfect and complete vesicles. Irregular growth may lead to more complicated formations such as the one seen in Figure 6. However, serial sections showed that the great majority of the rosettes represent complete spheres.

A survey of the rosettes in this case revealed many rosettes which show a definite indentation on one side (fig. 7). Other rosettes show even more advanced indentation on one side of their spherical form and in addition ingrowth of tumor cells into the lumen of the rosette from this area (figs. 8 and 9). In some rosettes this process of indentation and cell proliferation in one area of the wall has resulted in an early stage of invagination (figs. 9 and 11). It seems very important to mention that in several instances another much smaller rosette can be seen next to area of indentation of the larger rosette (fig. 10). Figure 11 shows the most advanced stage of such invagination of a rosette that was found in this case. Serial sections showed that the rosettes with the indentations are otherwise complete vesicles. It must be mentioned that the cuticular membrane of the rosettes is usually missing or much less developed in the area of indentation, cell proliferation, and invagination than in the remaining wall of the rosette.

Many pseudorosettes—rosettelike arrangement of tumor cells around blood vessels—are seen in the

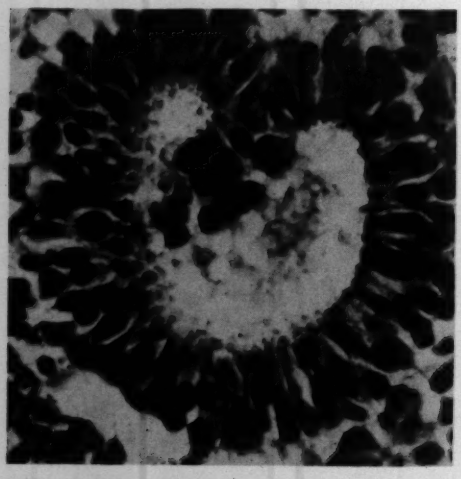

Fig. 8 (Wolter). A large rosette with advanced indentation and proliferation of a cell mass into its lumen. The inner membrane is not developed on the indented cells. (Hortega method, photomicrograph.)

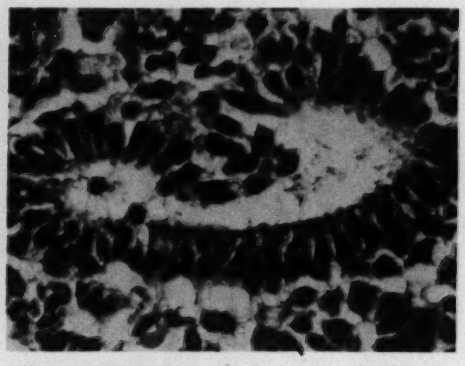

Fig. 9 (Wolter). A large rosette showing indentation and early invagination of its wall. (Hortega stain, photomicrograph.)

tumor. Figure 12 shows a typical example of such a pseudorosette.

Discussion

The neuro-epitheliomatous retinoblastomas are believed to develop from the outer retinal layers. This is probably true in the present case since this tumor shows exophytic growth. Even in this late stage the whole tumor is still covered by the detached retina.

The peripheral parts of the tumor contained many rosettes of unusually large size. The largest ones measured up to about 100 microns in diameter. The size of rosettes in usual neuro-epitheliomatous retinoblastomas of our collection is about 20 to 40 microns. Serial sections showed that virtually all rosettes represent vesicles of round or oval shape.

Rosettes in retinoblastoma were first described by Flexner.[8] Wintersteiner[9] confirmed this finding a few years later. Rosettes are considered a sign of a certain differentiation of tumor cells. Some authors interpreted the rosettes as representing an abortive attempt of the tumor to form the layer of the rods and cones of the outer retina (Flexner,[8] Wintersteiner[9]).

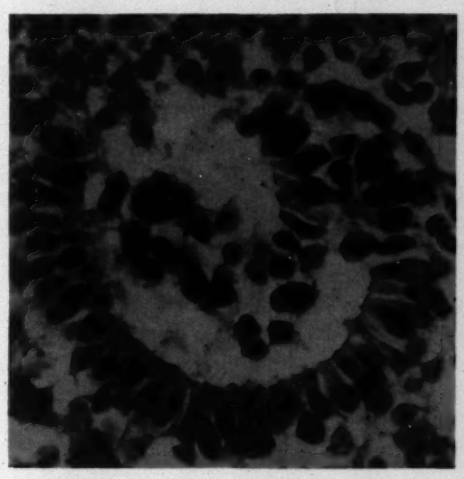

Fig. 11 (Wolter). The most advanced stage of invagination seen in a rosette of this tumor. The cells of the invaginated part are of a more irregular arrangement. (Hortega stain, photomicrograph.)

Marchesani[10] expressed the opinion that rosettes do not represent the highly differentiated rod-and-cone cells but structures comparable to the primitive neural tube. Pusey[11] thought that the rosettes are formed from primitive neuroglia corresponding to the fibers of Mueller. Munoz Urra[12] stained

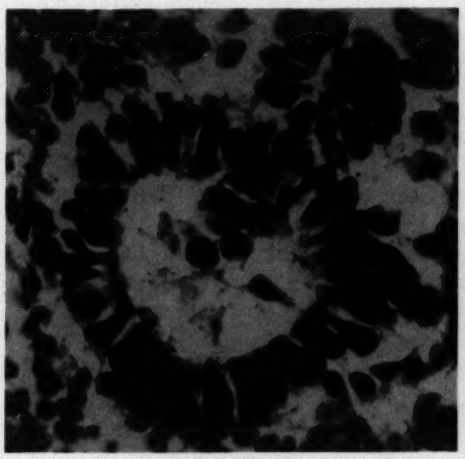

Fig. 10 (Wolter). A large rosette with indentation of its wall. Another smaller rosette is adjacent to the area of indentation of the large rosette. (Hortega stain, photomicrograph.)

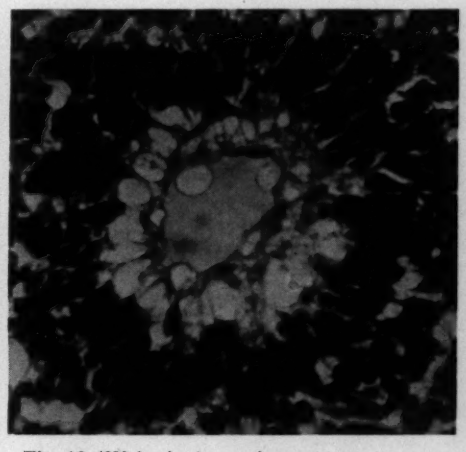

Fig. 12 (Wolter). A pseudorosette—arrangement of palisading tumor cells around a blood vessel seen in this case of neuro-epitheliomatous retinoblastoma. (Hortega stain, photomicrograph.)

retinal rosettes with tannin silver stain and advanced the theory that rosettes are formed by tumor cells arranged around the processes of an astrocyte not stained by ordinary methods.

Parkhill and Benedict[2] believe that the the elements of rosettes should not be compared to normal retinal cells but represent peculiar dedifferentiated tumor cells with their own special characteristics. It is important to emphasize that rosettes are found not only in retinoblastoma but also in the neuro-epithelioma of the brain (comp. Reese[4]).

The large rosettes in the present case show a number of interesting details which stimulate some thoughts. Star-shaped cells with round nuclei are seen in many—but not in all—of the rosettes. These cells look somewhat like astroglia of the retina. This finding is in a certain way a confirmation of the findings of Munoz Urra.[12] However, in our slides, there is no evidence at all that the star-shaped cells in some of the rosettes cause the rosette formation. Furthermore, the star-shaped cells in the rosettes of the present case are very well visible with the ordinary methods.

Another interesting fact is that the large rosettes of this case are not composed of just one simple layer. Their walls are composed of slender cells with foot plates on the lumen of the rosette. The nuclei of these cells are arranged somewhat like the cellular nuclei in a layer of the retina.

The last—and probably most fascinating fact—is that many of the rosettes show changes which look much like an attempt at invagination. It has to be emphasized that this process usually occurs in an area where the cuticular membrane of the rosette is not well developed. Thus, it is possible that this picture of invagination is actually caused by a defect in the rosettes through which surrounding tumor cells protrude into the lumen of the rosettes.

The observation of Meyer-Schwickerath[13] that rosettes may have a defect in their wall and represent incomplete spheres would support this explanation. However, there is another finding supporting the view that this process actually represents an attempt at invagination.

With a little imagination one could accept the large rosettes in this case as attempts of the primitive tumor cells to form abnormal optic vesicles. What would a dedifferentiated retinal tumor cell rather do than form a primitive optic vesicle? Invagination would be the next step in the development of these optic vesicles.

In the development of the eye the neuro-ectoderm is known to stimulate the formation of the lens in the surface ectoderm. In this tumor we find in some instances another smaller rosette right on top of the invagination of the large rosettes (see fig. 11). Could this mean that hormones of this invaginating part of the optic vesicle cause the formation of another rosette of tumor cells instead of a lens?

This case permits many thoughts and speculations but no conclusions. The report of a neuro-epitheliomatous retinoblastoma with unusually large and differentiated rosettes remains as the only positive result of this study. However, the findings may stimulate further research.

Summary

A case of a neuro-epitheliomatous retinoblastoma is reported. This tumor exhibits rosettes measuring up to 100 micron in diameter with thick and complicated walls and star-shaped cells in their lumen. Changes in the wall of large rosettes imitate the process of invagination of the primitive optic vesicle.

Eye Clinic,
University Medical Center.

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A NEW OPERATION FOR GLAUCOMA*

AKIRA NAKAJIMA, M.D., KAZUO KANKI, M.D., AND MICHIKO TAKAYAMA, M.D.
Tokyo, Japan

I. INTRODUCTION

Numerous operations for glaucoma are described in every textbook of ophthalmic surgery. They are divided into two main categories—operations aimed at filtration scar formation and those aimed at restriction of aqueous humor production. Cyclodiathermy is the most widely used operation in the latter category but its use is considered to be limited to cases of absolute glaucoma in which no other operation has proved useful, or in rare cases of hypersecretive glaucoma.

Most of the widely used operations for glaucoma are aimed at filtration scar formation to obtain greater facility of aqueous outflow, the decrease of which is considered to be the main cause of glaucoma (Grant, 1959). Trephination, iridencleisis, goniotomy or cyclodialysis are widely used procedures, and the selection of operation seems to be left to the surgeon's preference rather than to the applicability of the operation.

Such a wide range of choice of operations seems to indicate the need for further improvement of operative procedures. In fact, our experience indicates that the existing operations have some drawbacks as well as advantages.

In contrast to cataract surgery, operations for glaucoma are usually performed on eyes which have little or no impairment of visual function; the operative treatment is a preventive measure against the visual loss which will occur if the eye is left untreated for several years (Goldmann 1959). Even in acute cases, since the vision before the attack is generally good, any operation should bring as little danger of visual impairment as possible. This is going to be more important as the methods of early diagnosis of this disease improve (Weekers, 1959). In short, any operation for glaucoma should be considered a prophylactic measure to preserve vision, contrary to such operations as cataract operations which aim at restoration of visual function.

The anterior chamber angle is thought to be important in the cause of glaucoma and many investigations on the histology or

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* From the Department of Ophthalmology, Juntendo University, Bunkyo-ku, Tokyo. Presented at the Pan-Pacific Surgical Congress, Honolulu, Hawaii, October, 1960.

Fig. 1 (Nakajima, Kanki and Takayama). Conjunctival incision.

macroscopic changes of this area have been reported (Dvorak-Theobald, 1959, Flocks, 1959, Garron and Feeney, 1959, Wolter, 1959, and others). Although a piece of tissue is dissected by trephination or sclerectomy, it is discarded without using it as a biopsy specimen, presumably because the method of dissection is not suitable for this purpose. Considering, however, the importance of the anterior chamber angle in the pathology of glaucoma, it would add much to the progress of glaucoma research and diagnosis if a method of operation for glaucoma were devised which would permit taking a biopsy specimen of the chamber angle.

We recently devised such a method.

The procedure to be described in detail in this report is a combination of cyclodialysis and sclerectomy and is, in our opinion, an improvement over present procedures. Experience in operating on more than 30 eyes shows that the operation is easy to perform, requires no special instruments and the results are usually excellent. A small piece of tissue of the anterior chamber angle, taken by this procedure, allows histologic examination of the changes at this site.

2. Operative procedure

Cyclodialysis is performed a few mm. from the anterior chamber angle, a rectangular piece of sclerocorneal tissue is dissected by inserting scissors through the scleral wound into the anterior chamber, and a basal iridectomy is done. A step-by-step description follows:

A. *Dissection of conjunctival flap.* After a bridle suture is placed at the superior rectus, the conjunctival flap is dissected just as in trephination or iridencleisis. It is better to have the conjunctival flap a bit larger than in trephination, and the end of the conjunctival incision should be one to two mm. from the corneal margin to be sure of wound closure after conjunctival suture (fig. 1). Dissection of episcleral tissue is easier with scissors than knife for there is less danger of breaking the flap by scissors (fig. 2). The dissection of the flap is performed as close to the corneal margin as possible (fig. 3). If the margin of the flap does not reach far enough, resection of the sclerocorneal tissue will not reach the anterior chamber angle; if it goes too far into the cornea, the opera-

Fig. 2 (Nakajima, Kanki and Takayama). Dissection of conjunctival flap.

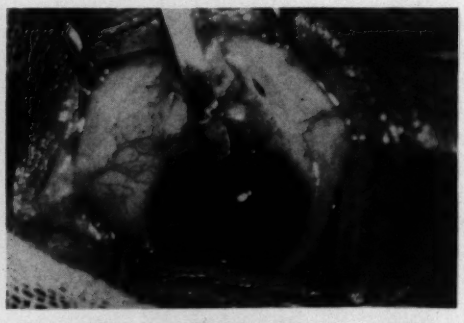

Fig. 3 (Nakajima, Kanki and Takayama). The extent of the dissection of the flap.

Fig. 4 (Nakajima, Kanki and Takayama). Scleral incision.

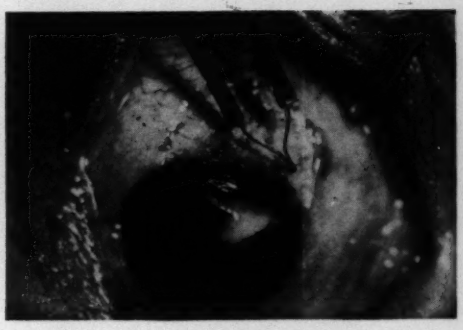

Fig. 6 (Nakajima, Kanki and Takayama). Cauterization is used to stop bleeding.

tion may cause disturbance of corneal circulation, indicated by temporary corneal edema.

B. *Scleral incision.* The sclera is incised with a knife for about one cm. parallel to the corneal margin and four to six mm. back from the corneal margin of the conjunctival flap (fig. 4). This incision should be made perpendicular to the scleral surface and should reach the surface of the ciliary body which is a few mm. from the anterior chamber angle (fig. 5). The following technique is useful in making certain of the place of incision.

Indirect illumination to the anterior chamber angle reveals the site of the angle through the sclerocorneal margin. The incision should be a few mm. back from this margin on the scleral side. After half of the sclera is incised, the corneal side of the wound is grasped by iris forceps, and the incision is continued carefully, keeping the wound open by iris forceps. As the incision comes nearer to the surface of the ciliary body, the scleral side of the wound is pushed gently with the back of the knife to open the wound to see whether the incision has reached the surface of the ciliary body. All bleeding should be stopped by cauterization before and during the making of the incision (fig. 6).

C. *Cyclodialysis.* Cyclodialysis is performed as it usually is, except that the central part of the wound is left untouched in order to obtain a complete biopsy specimen. In other words, cyclodialysis is performed on both sides of the wound. As the scleral wound is nearer to the corneoscleral margin than in ordinary procedures, this procedure is easier and much less dangerous (figs. 5 and 7). Some aqueous will flow out at this stage.

D. *Resection of sclerocorneal tissue.* The tip of straight ophthalmic scissors is introduced through the wound up to the anterior

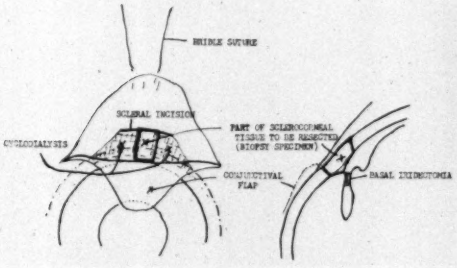

Fig. 5 (Nakajima, Kanki and Takayama). Diagram to show site of incision and sclerocorneal resection.

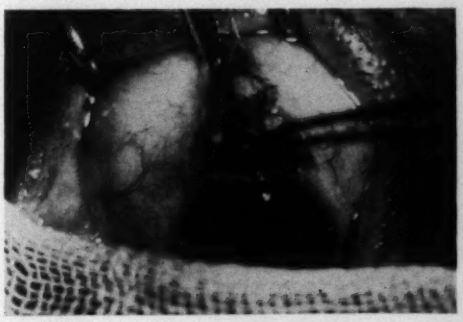

Fig. 7 (Nakajima, Kanki and Takayama). Cyclodialysis.

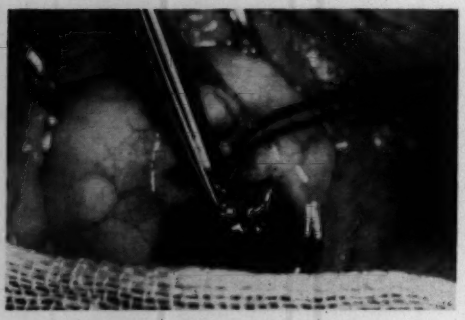

Fig. 8 (Nakajima, Kanki and Takayama). Sclerocorneal incision.

Fig. 10 (Nakajima, Kanki and Takayama). Resection is finished.

chamber to just behind the corneal margin of the conjunctival flap, pulling the sclera upward by iris forceps and by the tip of the scissors, and a straight scissors incision is made perpendicular to the corneal margin, extending from the wound to the edge of the flap (fig. 8). Most of the aqueous flows out at this stage, the anterior chamber collapses, the pupil dilates, and the iris root bulges out of the incision.

A small (one to two mm.) incision is then made parallel to the corneal margin at the corneal end of the first incision. The corneoscleral flap thus made is grasped by iris forceps at the scleral edge, and a small rectangular piece of sclerocorneal tissue is resected with straight ophthalmic scissors. The central part of the tissue is carefully separated from the base, with some iris or ciliary body tissue attached to the resected tissue to obtain a complete biopsy specimen. If the bulged iris root interferes with further manipulation, it is collapsed by making an iridotomy at the center of the bulged part (figs. 9 and 10).

The resected biopsy specimen is attached to a small strip of paper with the episcleral side stuck to the paper and placed in an appropriate fixative for later histologic examination. The iris pigment of the specimen is useful in distinguishing the proper position of the specimen on the paper.

E. *Iridectomy.* Basal iridectomy is performed just as in trephination. The iridectomy should not be too large and care should be taken not to injure the ciliary body. A spatula is introduced after the iridectomy through the wound to let the iris go back to it original position, if necessary (figs. 11 and 12).

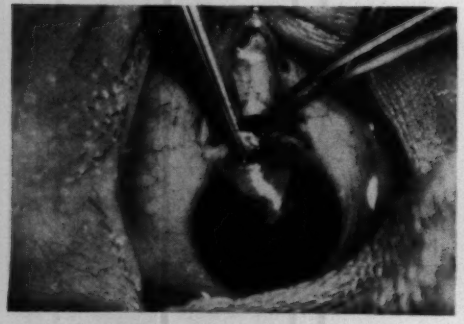

Fig. 9 (Nakajima, Kanki and Takayama). Rectangular piece of sclerocorneal tissue is resected.

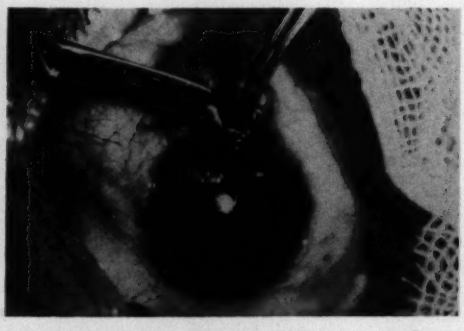

Fig. 11 (Nakajima, Kanki and Takayama). Basal iridectomy.

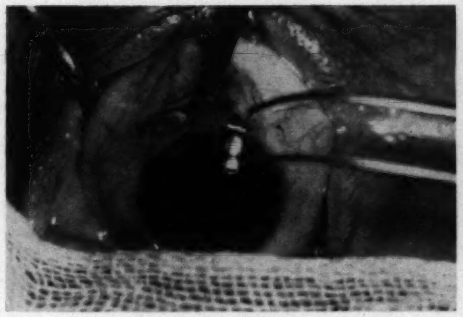

Fig. 12 (Nakajima, Kanki and Takayama). Reposition of iris.

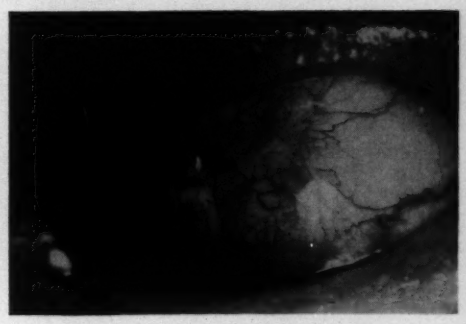

Fig. 14 (Nakajima, Kanki and Takayama). Site of operation three weeks after surgery.

F. *Conjunctival suture.* The conjunctival wound is sutured with a continuous black silk suture, after making certain that no trace of blood remains in the anterior chamber (fig. 13).

3. Treatment before and after operation and complications

A. *Treatment before operation.* A few days before operation, miotics should be replaced by Diamox or Neptazane to avoid miotic iridocyclitis (Abraham, 1959). General physical examinations, especially of the cardiovascular system, are done in addition to the routine ophthalmic examinations for glaucoma.

B. *Postoperative care.* Antiglaucomatous drugs are stopped on the day of operation. Blood coagulants, antibiotics and corticosteroids are administered orally on the day of operation and continued for a few days.

The patients should be at absolute bedrest for a day to avoid bleeding into the anterior chamber. Severe coughing or any other action which might cause blood stagnation in the region of the carotid arteries should be avoided.

The anterior chamber will not form for a few days, and it may remain shallow afterward. The pupil is in its natural state but synechias of the iris root may be avoided by instillation of miotics after an appropriate period. Corticosteroids are used topically after the removal of the conjunctival suture.

C. *Postoperative complications.* Postoper-

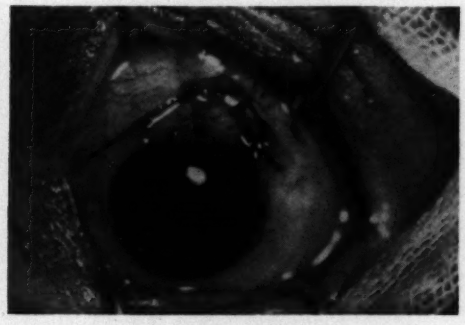

Fig. 13 (Nakajima, Kanki and Takayama). The conjunctiva is sutured.

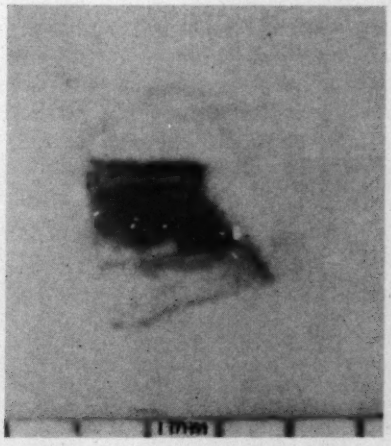

Fig. 15 (Nakajima, Kanki and Takayama). Dimension of specimen taken at operation. (Right eye of man, aged 62 years, with simple glaucoma.)

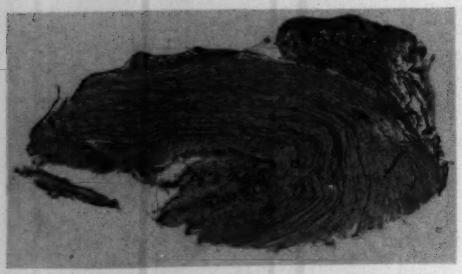

Fig. 16 (Nakajima, Kanki and Takayama). Histologic section of biopsy specimen, (×40).

ative complications observed in our series of more than 30 operations were:

a. *Bleeding into the anterior chamber.* This complication was observed a few days after operation in two cases in our series. In both cases, the cause of bleeding was fairly clear: in one case, unconscious touching of the operated eye with the finger during sleep and, in the other case, by severe coughing which came on suddenly during sleep. The bleeding was absorbed in about a fortnight without any treatment in the first case, leaving a thick scar around the bleb; the scar had to be removed to make the operation effective. In the second case, the blood in the anterior chamber had to be washed out and an additional procedure was necessary to remove thick scar around the bleb in order to normalize the intraocular pressure.

b. *Choroidal detachment* was observed in a case of absolute glaucoma with retinitis pigmentosa a few days after operation. It

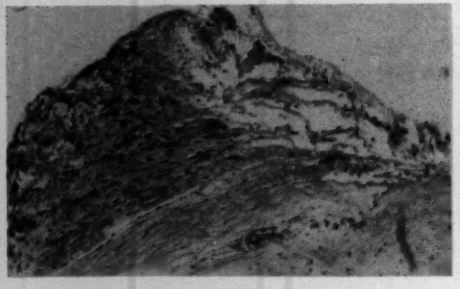

Fig. 17 (Nakajima, Kanki and Takayama). Same as Figure 16, ×110.

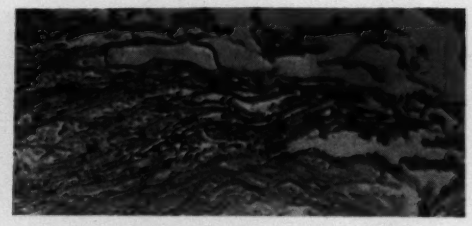

Fig. 18 (Nakajima, Kanki and Takayama). Same as Figure 16, ×220.

disappeared in a week or so without any treatment.

c. *Edematous swelling of the cornea and aseptic reaction of the iris* is a complication which causes temporary impairment of vision. It usually starts several days after operation and lasts for a week or so. This complication was observed in three cases in our series. In all of these cases, the histologic examination of the biopsy specimens revealed that the resected tissue contained a fair amount of Descemet's membrane (figs. 22 and 23), indicating that sclerocorneal resection had gone too far into the cornea. The cornea becomes thicker without becoming cloudy and a few striae can be seen by slitlamp examination at the back surface of the cornea. The iris becomes slightly edematous and partial posterior synechias occur, although, strangely, no sign of iritis is seen even with high magnification of the slitlamp microscope. Vision is usually greatly impaired at this stage. However, this condition disappears without any treatment within a week

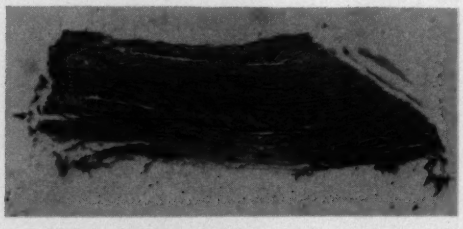

Fig. 19 (Nakajima, Kanki and Takayama). Section of biopsy specimen cut parallel to the angle (Simple glaucoma, a man aged 54 years, left eye, ×40).

Fig. 20 (Nakajima, Kanki and Takayama). Same as Figure 19, ×110.

or so and no symptom except for slight synechias remains.*

In summary, no severe complications which cause permanent impairment of vision have been observed so far in our series. Likewise, no severe late complication is anticipated in our series of cases, though the period of observation after operation is still only a few months. However, observation will be continued until we have convincing evidence of the safety of this operation.

* A series of more than 50 operations were done since the preparation of this article. Complications experienced were: a case of hyphema and two cases of slight iridocyclitic reaction which was controlled by extensive use of corticosteroids. The results of the follow-up study, to be published soon, are very promising.

Fig. 21 (Nakajima, Kanki and Takayama). Same as Figure 19, ×220.

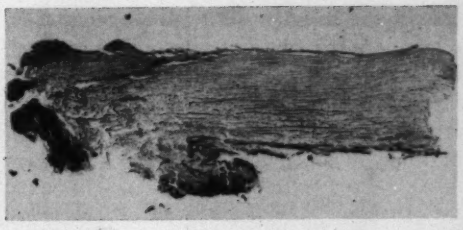

Fig. 22 (Nakajima, Kanki and Tayama). Biopsy section from a case of simple glaucoma in a man aged 56 years. There was corneal edema after operation. Notice Descemet's membrane. (Right eye.)

4. Results of operation

A detailed analysis of the results will be given in a later study. Except for a few cases in which the effect was not sufficient, all cases in our series have, so far, been successful. In a case of secondary glaucoma caused by trauma, three successive operations of this type were necessary to bring the intraocular pressure to normal. The patient was a young girl and the production of aqueous was highly impaired, whereas, the wound healing was very good. In such a case, any operation aiming at the formation of a filtration scar is, in our experience, seldom successful. Postoperative therapy to enhance aqueous production and to suppress granulation to some extent may be necessary in such cases.

The bleb formed by the operation herein decribed is usually even, wide and not so elevated as in trephination. It is scarcely noticeable in some cases (fig. 14). The de-

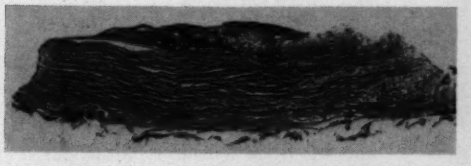

Fig. 23 (Nakajima, Kanki and Takayama). Biopsy section from a case of simple, narrow-angle glaucoma in a man aged 71 years. There was corneal edema after operation. (Left eye.)

fect of the sclera made by the operation is covered by coarse subconjunctival tissue and ultimately becomes almost unnoticeable in the majority of cases. In some cases, the bleb is seen on the conjunctiva of the operated part only by slitlamp examination.

5. Handling of the biopsy specimen

As the biopsy specimen is very small, utmost care should be taken in handling it properly. The best way, as already mentioned, is to place it on a small piece of paper in the proper position. A serial section through the proper plane is necessary to get a good slide of the specimen. Even if it is cut obliquely, the entire pattern can be visualized by examining serial sections in order.

Examples of sections of the biopsy specimens are demonstrated in Figures 15 through 23. It will be seen that, though there is some deformation, the slides contain the necessary parts for the study of the anterior chamber angle. A detailed study of the histologic findings obtained by this operation will be published later.

6. Comment

This new operation is a combination of a modified version of cyclodialysis and sclerectomy and, since those operations have been performed for a long time as routine procedures in glaucoma, this new technique should have the same features. Our experience in our series of cases proved the results of this operation to be even better than those of existing procedures, with fewer complications. In addition, the operation can be repeated on the same eye several times, and it will not interfere with cataract operation if this should be necessary later.

Among the complications of this operation, corneal edema with an iris reaction needs comment. Such a complication can be expected if resection of sclerocorneal tissue is made so far into the corneal tissue as to damage the corneal endothelium. However, that corneal edema should accompany an aseptic iris reaction, with partial posterior synechia, was entirely unexpected. This iris reaction may be caused by a slight iridocyclitis due to operative trauma on the surface of the sensitive ciliary body. However, this does not explain why it always accompanies corneal edema and little cell emigration into the anterior chamber. At the moment, it seems to be more reasonable to assume that this iris reaction is caused by some circulatory disturbance due to the operation. In fact, slight edema of the fundus is observed a few days after any effective operation against glaucoma and the change in ocular circulation could be enhanced by corneal edema. This complication, however, is only transitory. Studies on changes of ocular circulation caused by antiglaucomatous operations, an interesting problem in itself, will settle this point.

A big feature of this operation is that it permits histologic studies of the anterior chamber angle. There are two points to be mentioned here.

First, as shown in Figures 15 through 23, the specimen taken at this operation contains all of the necessary parts of the anterior chamber angle, although there is some deformation. Thus, the biopsy specimen can reveal any change in this area which may be responsible for the disease. The changes which underlie decreased facility of aqueous outflow may be histologically detectable, but any physicochemical change cannot be detected by conventional histologic techniques. Some special technique of processing the specimen may be necessary to make full use of this biopsy specimen.

Second, the histologic findings reveal the changes at one particular part of the anterior chamber angle. Unless the changes are generalized, it is not safe to picture the whole pattern from the findings in such a small specimen. This point is inherent in every biopsy technique but, in the case of glaucoma, the changes in the anterior chamber angle are considered to be generalized, otherwise there would not be a rise in intraocular

pressure. However, the specimen taken by this operation may be useful in interpreting the pathology of glaucoma. Moreover, this point can be checked to some extent macroscopically by gonioscopy.

7. Summary and Conclusion

The new operation against glaucoma described in this report is essentially a combination of cyclodialysis and sclerectomy, easy to perform, with excellent results and allowing a biopsy examination of the anterior chamber angle at the same time.

By this method all types of glaucoma in all stages can be treated satisfactorily. The details of the operative procedure, complications and preoperative and postoperative care, results in a series of more than 30 cases and histologic findings of the biopsy specimen taken at operation have been presented.

Juntendo University.

Acknowledgment

We wish to acknowledge with gratitude the warm support of the late Prof. T. Sato and all the staff of our department during this study. We are also grateful to Prof. K. Hashimoto and his staff, Department of Pathology, Juntendo University, for technical help and useful suggestions on the pathology of the specimens, to Dr. N. Ogino, Department of Ophthalmology, Yokohama Medical College, for valuable discussions, and to Dr. N. Jackman for help in preparing the article.

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A COMPARISON OF TWO SCHOOL VISION SCREENING TESTS*

James F. Gentile, Ed.M., and Philip W. Johnston, Ph.D.
Boston Massachusetts

In 1938, the Massachusetts Department of Public Health became actively interested in improving school vision screening procedures. As a result of research carried out at that time, the Massachusetts Vision Test was developed. For more than 20 years this screening method has provided good results in many school districts throughout the country. Of late, however, severe overcrowding in some schools has made it difficult to obtain the space required to give this test in its original form. This crowding factor has renewed interest in screening instruments which require a minimum of school space.

* From the Massachusetts Department of Public Health, Division of Maternal and Child Health.

Before such instruments as the Bausch and Lomb School Vision Tester could be considered for routine screening in the schools of Massachusetts, several questions had to be resolved. It was necessary, for example, to determine if there was any factual basis to the "psychologic accommodation" effect attributed to this type of device; through this effect the subject supposedly becomes aware of the physical nearness of the test symbol and this awareness introduces some degree of accommodation even though optically the test symbol is at infinity.

This problem and others were referred to the Committee on School Vision Tests of the New England Ophthalmological Society. Specifically the committee was asked if the Bausch and Lomb School Vision Tester could be recommended for vision screening in schools. Since reliable statistical data relative to the performance characteristics of the Bausch and Lomb School Vision Tester were not available, the committee formally requested the Massachusetts Department of Public Health to undertake a study which would provide data for evaluation. The results of the study are described herein.

Purpose of study

The immediate purpose of this study was to compare under field conditions the performances of a Bausch and Lomb School Vision Tester and a standard Welch Allyn version of the Massachusetts Vision Test. After exploration of the technical and administrative problems, a plan was devised to provide the data for a comparison of these two devices.

Plan of study

Eight cities and towns, geographically scattered throughout Massachusetts, were selected for participation on the basis of willingness to co-operate, presence of qualified test personnel and availability of pupils. The experience of the various testers varied considerably. One tester had approximately a year of experience in administering the Welch Allyn version of the Massachusetts Vision Test, while other testers had used this same type of equipment for more than five years. None of the testers had actually used the Bausch and Lomb School Vision Tester before the study; therefore, each tester was given a full day of training on the Bausch and Lomb instrument immediately prior to the start of his test work. Because of their previous vision screening experience, the testers became quite proficient in the administration of the Bausch and Lomb school test by the end of one day of training. A major part of the training consisted of practice tests on children from various grade levels and a thorough briefing on how to handle anticipated problems. Testers were visited frequently during the study to make sure that recommended procedures were maintained.

Each of the eight cities and towns used its own Welch Allyn version of the Massachusetts Vision Test. However, all testers used a single Bausch and Lomb instrument, which was purchased by the Massachusetts Department of Public Health to carry out this study. The Bausch and Lomb School Vision Tester has three photographic test slides which are used as follows: (1) Snellen symbols for testing visual acuity and latent hypermetropia; (2) a simultaneous test for vertical and horizontal heterophoria at distance; (3) a simultaneous vertical and horizontal heterophoria test at near.

One pair of 1.75-diopter plus-sphere lenses, mounted in a metal frame, is also provided with the Bausch and Lomb equipment. These lenses are used in conjunction with the visual acuity slide to provide the test for latent hypermetropia. Since the Massachusetts Vision Test uses 2.25-diopter plus-sphere lenses to test children in grades 1, 2 and 3, an additional frame carrying 2.25-diopter plus-sphere lenses was added to the regular Bausch and Lomb equipment. This was the only change in equipment made for this study.

The study procedure involved selecting

TABLE 1

STANDARDS FOR GRADE LEVELS

	Grades 1, 2 and 3	Grades 4 through 12
	Fail	Fail
Visual acuity	Less than 20/40–2, either eye	Less than 20/30–2, either eye
Hypermetropia	20/20 through a 2.25 diopter plus sphere lens, either eye	20/20 through a 1.75 diopter plus sphere lens, either eye
Phorias	Omitted	AT DISTANCE More than 1.25 prism diopters of hyperphoria More than 4.0 prism diopters of exophoria More than 6.0 prism diopters of esophoria AT NEAR More than 6.0 prism diopters of esophoria More than 8.0 prism diopters of exophoria

the names of six boys and six girls at random, from each grade, 1 through 12. In order to minimize bias and learning factors, testing was done in the following sequence: Boys No. 1, No. 3 and No. 5 in each grade were tested first with the Welch Allyn version of the Massachusetts Vision Test and immediately thereafter each was tested with the Bausch and Lomb equipment. Boys No. 2, No. 4 and No. 6 in each grade were tested with the Bausch and Lomb equipment first and then each was immediately given the test with Welch Allyn equipment. The same routine was followed in testing the girls until all children had received tests with both instruments.

Testing was terminated with either test when a child received a failing mark in any subtest. Before any child was awarded a failing score with either test, a careful performance check was made to insure that the failure was not due to confusion or misunderstanding of the test instructions. Children who wore glasses were given all tests with their glasses on.

After the children were given the first set of tests, at least two days but less than 20 days, were allowed to pass before retesting was undertaken by the same tester. The retesting phase of the study followed the same pattern as the original routine, with the exception that children who received the Welch Allyn test first were given the Bausch and Lomb school test first, and vice versa.

If a child was absent for retest, his or her name was removed from the study. A replacement child of the same sex and grade was substituted and this replacement was given the four tests in the same order prescribed for the absent child. Each tester was instructed in advance not to attempt to remember how any child performed on a previous test. Actual testing work began in December, 1957, and this phase of the study was completed by the end of April, 1958.

The average test time per pupil during the study was one minute and five seconds for the Welch Allyn version of the Massachusetts Vision Test and one minute and 10 seconds for the Bausch and Lomb school test. Time was measured from the moment the child sat in the test chair until the test was completed. All timing was done during the retesting phase of the study. One odd-numbered boy and one even-numbered girl in each grade were timed. The difference in actual average testing time between these two tests obviously was negligible.

The criteria for passing and failing were the same for both tests. Two sets of standards, corresponding to different grade levels, were used (table 1).

STUDY RESULTS

A total of 1,128 children were tested. Test scores of four children were omitted from the analysis. Statistical procedures similar to those utilized in the Saint Louis Study[1] were used to analyze the test results on 1,124 children.

TABLE 2

FAILURE RATES BY COMMUNITIES

Community	No. Tested	Percent Failed Welch Allyn First Test	Percent Failed Bausch and Lomb First Test	Percent Failed Welch Allyn Retest	Percent Failed Bausch and Lomb Retest
A	142*	5.6	7.0	6.3	7.7
B	143†	11.2	10.5	11.9	12.6
C	120‡	10.8	12.5	10.0	10.0
D	144	9.7	6.9	6.9	6.9
E	144	5.6	6.9	6.3	4.2
F	143§	6.3	6.3	6.3	5.6
G	144	6.3	7.6	5.6	4.9
H	144	8.3	8.3	6.3	7.6
TOTALS	1,124	89	92	83	83
OVERALL FAILURE RATES		7.9%	8.2%	7.4%	7.4%

* Two children omitted: one child absent during retests; other child forgot glasses.
† One problem child omitted; wanted glasses so deliberately pointed wrong way.
‡ This community had no children in grades 11 and 12.
§ One child had her glasses changed between tests.

In the report of the Committee on School Vision Tests,[2] which provided the basis for the present Massachusetts Vision Test referral standards, it is recommended that all heterophoria tests be eliminated in grades 1, 2 and 3. This has been done. This report also recommended that near heterophoria tests be made optional in grades 4 through 12. Since many Massachusetts schools do not use the near heterophoria test, it was decided that the statistical analyses for this study would not include the results of near heterophoria tests. It can be stated, however, that, if the results of near heterophoria tests were included in the analyses, their effect would be to elevate failure rates, to lower test-retest reliability coefficients and to lower the correlation obtained between the Welch Allyn scores and Bausch and Lomb scores.

Table 2 shows the failure rates obtained with Welch Allyn and Bausch and Lomb equipment by communities. Failure rates by grades are shown in Figure 1.

Before determining the degree of correlation between the Bausch and Lomb and Welch Allyn equipment, the reliability of each instrument was ascertained. Since all test scores in this study fell into "pass" or

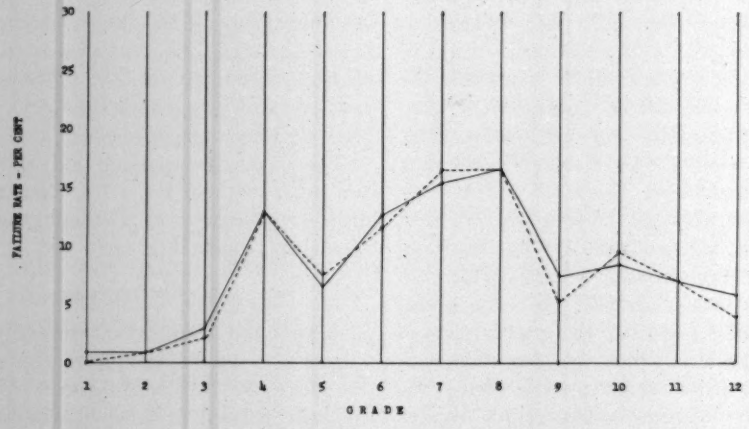

Fig. 1 (Gentile and Johnston). Graph of failure rates on Welch Allyn (broken line) and Bausch and Lomb equipment (solid line).

"fail" categories, the point correlation coefficient method was employed as the measure of reliability. Test and retest scores for each instrument were assembled into 2 by 2 scatters and the point correlation coefficient computed to show the degree of correspondence between test and retest scores. The test and retest scores for the Welch Allyn equipment showed a point correlation coefficient of 0.80. The Bausch and Lomb equipment also had a test and retest correlation coefficient of 0.80. In view of the present state of development of vision screening devices generally, a reliability coefficient of 0.80 may be regarded as satisfactory for school screening work.

In a determination as to the extent to which the two instruments agreed with each other, another set of 2 by 2 scatters was constructed using the scores from the first Welch Allyn test and the first Bausch and Lomb test. The point correlation coefficient computed from the scatters was 0.76. It appears, therefore, that the Bausch and Lomb School Vision Tester measures essentially the same visual functions as does the Welch Allyn equipment.

Conclusions

Analysis of the data from this study indicates that both the Welch Allyn instrument and the Bausch and Lomb School Vision Tester have adequate levels of reliability for school vision screening tests when the tests are carefully administered by competent personnel.

Comparison of scores obtained by testing the same children with Welch Allyn and Bausch and Lomb instruments resulted in a point correlation coefficient of 0.76. This is excellent agreement when viewed in the light of the results of the Saint Louis study.

With due consideration for certain field advantages and disadvantages of each instrument, and provided that near phoria tests are omitted, each of these devices appears to measure the same visual functions with approximately equal reliability and efficiency.

88 Broad Street (10).

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PSYCHOLOGIC ASPECTS OF OPHTHALMOLOGIC PRACTICE*

Part I. Psychodynamics of looking; ocular neurosis

Alex H. Kaplan, M.D., and Benjamin Milder, M.D.
Saint Louis, Missouri

Introduction

Ophthalmologists are, of course, well aware of the importance of emotional disturbances in the causation of eye symptoms. It is interesting that the eye patient, speaking collectively, seems to have less insight into the possible functional nature of his complaints relative to his eyes or his vision, than is the case in other areas of medicine. The patient presents himself with a rather specific eye or visual complaint and he expects a precise, even mathematical resolution

*From the Department of Psychiatry (Dr. Kaplan) and the Department of Ophthalmology (Dr. Milder), Washington University School of Medicine. A portion of this paper was read at the February 25, 1960, meeting of the St. Louis Ophthalmological Society.

of his problems, generally in the form of eyeglasses. From the point of view of the patient, it makes little difference that the origin of the suffering eye may be related to some emotional conflict. He still expects that his doctor, fortified with his scientific knowledge and surrounded with the culturally accepted concept of an authority, will take care of the pain and suffering.

Although most patients translate this sense of confidence into complete co-operation with the diagnostic eye procedures and marked gratitude for the relief of symptoms or restoration of vision, there is a significant group who react to the eye manipulations as an attack on their person. These patients will exhibit either overt or repressed anxiety, the latter evidenced by hostility, avoidance, restlessness, lack of co-operation, vague symptoms and exaggerated reactions to pain.

Significance of the eye in normal psychologic development

It is recognized that the mouth plays a fundamental role in the psychologic development of the child in its earliest months of life. At about the age of three months, when the eyes become more useful as organs of perception, there is an acceleration in the psychologic and physical development. It seems that, when the child begins to see the world around him, he rapidly incorporates the environment into himself in the form of personality traits. These personality traits, laid down in the first year of life are maintained in adulthood, although they are modified by later emotional and physical development.[1]

Many psychologic and physiologic factors influence the patterns of behavior which a child develops in his early years of life. Among these are: heredity, constitutional factors, the child's maturation schedule, the parent-child relationship, illness, injury, the birth of siblings, as well as other normal and abnormal stresses of the environment. Conflicts which may be set up in the earlier years by these stresses produce an increase of tension in the infant and this is manifested by reactions of pain, primitive fear and rage—the prototypes of adult anger and hostility. If this tension continues to develop, the child manifests anxiety and fear of the stressful environment.[2]

Ordinarily, these early reaction patterns become part of the buried memory of the child, to be reactivated at new points of stress, such as physical illness and eye manipulations. When tension increases in adult life and anxiety becomes more disruptive, the patient may develop, as a defense against this anxiety, certain psycho-physiologic reactions (duodenal ulcer, hypertension and so forth), neurotic or psychotic patterns or other behavioral abnormalities, such as delinquency. Usually an individual reacts with the same learned pattern of somatic disturbance or psychologic reaction regardless of the nature of the stimulus. Thus, in reaction to varying types of stress, one individual may develop an ulcer, another a neurotic reaction with anxiety or abnormal fears, a third other personality disorders, and a fourth a psychosis.[3]

Psychologic aspects of looking

The eyes are the most important organ of perception, psychologically and physiologically. They serve many roles in normal growth and development, as well as assisting defensively to ward off psychic problems. As the child begins to perceive his environment, at first through a close relationship with his mother, then with other members of the family and finally with the environment outside of his family, he takes on attitudes and characteristics of those about him. The eyes play a fundamental role in this psychologic process of identification. It is as if the child unconsciously takes into himself, by way of the eye, characteristics of the people and activities about him, thus developing specific personality traits and behavioral patterns.

Since our emotional patterns are conditioned by past visual experiences, it is not surprising that the act of "looking" can ex-

press all of human emotions. Looking can express tenderness, affection or love. On the other hand, looking can express hatred, jealousy, anger, hostility and rage. We have often used the phrase "if looks could kill" to indicate how people can hate through the process of looking. Our dreams are predominantly visual, except that those persons blind at birth have auditory dreams. Looking transmits all of our emotional drives.[4] Interestingly, when psychiatrists illustrate the various conscious or unconscious parts of the personality, the mind is frequently portrayed as an eye interacting with the environment.

In the normal individual, looking generally leads to action. First we look, we see what needs to be done and then we carry out some integrated act. However, in the sick and the perverted individual, the fear of emotional discharge, the psychic conflict, blocks all action except looking. Such persons may look longingly, curiously, sexually, aggressively or hostilely, but are blocked in carrying out any significant action to release the tensions involved. Such patients may describe the "need to look" to protect themselves against anxiety. One patient, for example, whenever faced with concern of heterosexual actions, would tend to spend his time aimlessly looking at pictures of women in magazines[5,6] rather than looking to develop a relationship with the opposite sex.

Other individuals protect themselves against anxiety and tension by denying the need to look. A common example of this in ophthalmologic practice is the extremely myopic person who does not wear glasses because of the concern about bodily disfigurement. Unfortunately, like most neurotic symptoms, this pattern of reaction fails, and the same myopic patient draws the attention of other people to him because of his inability to see. Instead of the defect being ignored when glasses are worn, it is made more obvious by the difficult situations in which the myopic person finds himself.

The fact is that most neurotic individuals want to call attention to themselves, not as totally adequate persons, but as persons with defects, so that they may escape competition in their environment and justify a sense of dependency. Thus, the myope without glasses tells himself he is protecting his body image, while actually he is unconsciously exhibiting the visual defects. In many ways such individuals react like a small child who puts his hands over his eyes and then exclaims to the world "you can't see me now." Most neurotic symptoms are immature expressions which are normal in children, and certainly the latter example is a good illustration of this point.

Emotional factors affecting eye symptoms

In the past decade or more, the term "psychosomatic disease" has become a household word. Many illnesses, such as asthma, gastro-intestinal ulcer and hypertension, are commonly described as psychosomatic disorders. Such distinction between these specific diseases and all others is unwarranted for it is now commonly accepted that the human being functions as a whole unit to all forms of stress, mental or physical. Psychologic factors may be responsible for structural change in physical disease and, conversely, structural change in physical disease can be the most important etiologic agent in abnormal emotional states. The psycho-physiologic reaction (more recently substituted for "psychosomatic") must be differentiated from the neurotic reaction, the latter term being reserved for those disorders where psychologic symptoms play the major role. For example, an individual is said to be neurotic when he has fears, anxieties, obsessive compulsive symptoms (irrational repetitive acts and thoughts). These symptoms can be interpreted as having special symbolic meaning referable to the emotional conflict, but there are no physiologic changes of sufficient degree to produce organic disease.

The majority of patients seen by the oph-

thalmologist are not neurotic nor do they have psycho-physiologic illnesses. Their problems are the result of emotional factors which complicate rather than specifically produce eye disease. While most eye patients do not have obvious emotional disorders, they do have differing personality traits which cause them to react in specific ways to eye manipulation, some without anxiety and others with varying degrees of anxiety-stimulating reactions. These personality traits (sometimes psychologic defenses) are part of the total individual personality and, since the ophthalmologist does not treat an isolated eye but rather a whole person who presents an eye problem, it is necessary to understand something about the basic personality development of normal individuals and about those customary variations frequently met with in practice. Such a study of the science of psychodynamics is fast becoming an integral part of the medical school curriculum.[7]

Although fantasies and dreams of some neurotic patients picture the doctor and dentist as mutilators or aggressors, nevertheless, in the eyes of the average patient, the ophthalmologist plays the same role as other physicians. That is, he is a powerful parent figure who can relieve pain, restore eye function and magically enable the patient to realize his dreams of success in business, marriage or the restoration of youth. Patients often expect to suffer pain during treatment or examination of their eyes. This fear may be associated with the use of instruments in eye examination, such as the ophthalmoscopic examination of a child or in the measurement of the intraocular pressure in an adult. These procedures may reactivate early childhood fears of mutilation which exist in all people at all times but which are more exaggerated in neurotic individuals. In children between the ages three and six years, these feelings are considered quite normal. The child's fears are manifested by his arrival at the ophthalmologist's office bristling with "six-shooters" to protect himself. As the child becomes older, this fear of mutilation is repressed but may be reactivated at points of threatening aggression and bodily injury. The ophthalmologist's awareness of the basis for these hostilities in his office will reduce his own reactive hostility and facilitate an understanding of the patient's eye symptoms, interpreted in the light of the patient's reaction to the examination procedures instead of against the doctor.

Ocular neurosis

The term "ocular neurosis" represents, for most ophthalmologists, a rather vague concept. The expression is used to describe a broad variety of mild to serious ocular manifestations of emotional conflict. Considering the great frequency with which the ophthalmologist encounters such disturbances, the lack of interest in ocular neuroses, as shown by the rather tentative and insecure approach displayed in handling the problems, is somewhat surprising. In 41 consecutive years of publication of the transactions of the Section on Ophthalmology of the American Medical Association, only six papers dealt with psychoneuroses.[8] Nevertheless, it has been estimated that 75 to 80 percent of all eye patients have a psychoneurotic factor in their clinical picture.[9] Although only five to 10 percent of these patients are truly neurotic, the over-all incidence of psychoneurotic ocular symptoms is somewhat higher than in general medical practice. Some of the reasons for this high incidence may be found in the high degree of functional integrity required for our daily seeing tasks, as well as in the low threshold for discomfort which is characteristic of ocular structures, particularly the cornea.

One may well begin by defining ocular neuroses as disorders giving rise to recognizable ocular signs or symptoms without adequate physical cause but with emotional etiologic factors. By comparing the symptoms with the examination findings, one can readily select those patients who are candidates for a diagnosis of "ocular neurosis."

The symptoms which are encountered in ocular neurosis cover a broad spectrum, including visual disturbances which may range from blurred vision to hallucinations and sensory disturbances including pain, itching, burning, drawing sensations and headaches. One also encounters tearing, blepharospasm, retinal angiospasm and inadequate compensation for muscle imbalances.[10] Many of these symptoms are mild and some exist in the examination as concomitants of the anxieties and tensions induced by the examination procedure.

It is important to emphasize the role of the ophthalmologist in these ocular neuroses. If the doctor dismisses the patient's problems as "just nerves," he is endeavoring to make his own escape from the realities of the situation with which he is confronted. On the other hand, it is often tempting to skirt this relatively uncharted area by resorting to the clear-cut, precise solutions of spheres and cylinders. In either event, the patient receives neither sympathy nor truth. The picture has not changed materially since George Derby[11] wrote 30 years ago "from my observation I firmly believe that ophthalmologists produce more neuroses than they cure." The diagnosis of "ocular neurosis" is not made by exclusion, although the ophthalmologist may base a suspicion of this diagnosis on the comparison of the symptoms and findings, as well as on general personality factors.

It is necessary to determine just why the eye becomes the area of choice for the psychologic communication of the patient's tensions or emotional conflicts. In a patient with ocular neurosis, the choice of the eye for such psychologic communication is dependent on the focal importance of the eye at the time of the present conflict, as well as on the past personal history with its background of disturbed parent-child relationship. In other words, if symptoms of the eye are caused by psychologic reactions, one must not only look into the present circumstances which cause the conflict but also into the reasons why the eye played such an important role in the psychologic development of the patient. In order to make this diagnosis, then, positive evidence of psychic conflict must be elicited. The ophthalmologist must make sure that there is some situational conflict precipitating the present difficulty or perhaps that in the near past there were a series of circumstances which could be responsible for the present psychic conflict.

It is not too difficult for the ophthalmologist, by ordinary interest, insight and sympathetic handling, to obtain such a history in order to make the diagnosis and to assist the majority of patients so afflicted.

Situational neuroses yield readily to the understanding ophthalmologist:

A 35-year-old unmarried woman complained of headaches, burning of eyes and limited reading tolerance. Vision and muscle balance were normal. She was secretary to the president of a large public relations firm and had shared with him for one year the secret knowledge that he would retire at the end of the year. She was forced to conceal this knowledge in her work, although she knew that she would probably be replaced in the impending administrative change. Simple verbalization of this problem seemed to help her. Her own conclusion was: "Gee, no wonder I've been tense and upset. I guess that's what has been causing my headaches and burning." She was correct.

Another woman patient, aged 30 years, unmarried, had symptoms of asthenopia not relieved by glasses. She was referred to an internist for physical examination and he reported that she confided in him that she was overcome with guilt feelings because of her association with a married man. Mild psychotherapy and counseling by the internist were followed by relief of all symptoms.

Other more deep-seated neuroses may yield to the efforts of the trained psychotherapist. The unnecessary prescribing of glasses for such patients is an open invitation to the dissatisfied patient to avoid confronting his problem.

One must also pay attention to the reaction of the mentally ill or seriously disturbed neurotic patient to various eye procedures. Often a prepsychotic patient will begin to show his pathologic symptoms following eye examination. These patients are psychiatrically ill and need referral to psychiatric sources for further diagnosis and treatment, although the first diagnostic hunch will be made by the ophthalmologist.

A young man who was suspected of being very sick while living in Europe convinced his parents in the United States that he had no psychiatric difficulties. However, following a routine eye examination for eyeglasses, the patient became so acutely disturbed that he asked for hospitalization because of the development of acute paranoid symptoms.

Summary

To the patient, the ophthalmologist represents the powerful figure who will effect a release from the patient's eye symptoms. It makes little difference whether the symptoms are of organic or emotional origin.

The eyes play an important role in the emotional and physical development in the early years of life. They play many roles both in normal growth and development as well as in assisting defensively to ward off psychic problems. In the normal individual, the act of looking leads to a reaction in the form of integrated activity. In the disturbed individual, the psychic conflict may block all action except looking.

The procedures in eye examinations may produce varying degrees of anxiety reactions, by reactivating early childhood fears of mutilation. Such fears are, in themselves, not abnormal but tend to be exaggerated in neurotically disposed individuals.

"Ocular neurosis" may be suspected by the ophthalmologist if he understands basic personality traits and correlates the patient's symptoms with the organic findings. The pattern of ocular neurosis includes such symptoms as headache and burning and aching of the eyes, as well as pathologic changes such as vasomotor retinal disease and blepharospasm. The diagnosis of "ocular neurosis" is not made by exclusion but rather by eliciting positive evidence of the causative psychic conflict.

4652 Maryland Avenue (8).

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MANDIBULOFACIAL DYSOSTOSIS*

With the report of two cases

Guillermo Picó, M.D.
Santurce, Puerto Rico

Mandibulofacial dysostosis (Franceschetti's syndrome) is still an extremely uncommon condition but it is now realized that, like all so-called rare diseases, it is more common than it was once supposed to be. The considerable interest recently displayed in it seems to warrant a report of two additional cases, together with a review of the information now available concerning it and the syndromes apparently related to it.

Historical note

The first reports of mandibulofacial dysostosis are credited to Berry,[1] in 1889. His patients, a mother and daughter, presented congenital notches of the lower eyelid, the mother bilaterally and the daughter on the right side only, associated with receding chins.

In 1900, Treacher Collins[2] described similar anomalies of the eyelids associated with defects of the malar bones. A number of other reports followed, but it was not until the comprehensive studies of Franceschetti and his associates were published in 1944[3] and 1949[4] that mandibulofacial dysostosis was clearly understood. When all the published reports were put together, it was evident that while the associated malformations may vary in degree and extent, mandibulofacial dysostosis is a single clinical entity.

The term Treacher Collins' syndrome was used for this condition after his description of it in 1900, but, from what has just been said, it is obvious that if an eponym is to be used for the disease, the term Franceschetti's syndrome is preferable.

Clinical classification

Franceschetti and Klein,[4] while pointing out that a sharp distinction cannot be drawn between the categories, divided mandibulofacial dysostosis into five groups, according to the degree of deformity, as follows:

1. *The complete form.* In the fully developed syndrome the typical findings include:

A. Obliquity of the palpebral fissures downward and laterally (antimongoloid), with a coloboma in the outer portion of the lower lids and sometimes in the upper lids also. The lower lids are S-shaped. The deformity of the palpebral aperture and of the lower lids is due to underdevelopment of the malar bones.

B. Hypoplasia of the facial bones, especially of the malar bones and the mandible, which produces the characteristic fishlike physiognomy with receding chin.

C. Malformation of the external ear and, in some instances, of the middle and inner ear also.

D. Macrostomia, high palate, and abnormal position of the teeth, with resulting malocclusion.

E. Blind fistula between the angles of the mouth and the ears.

F. Tongue-shaped growths of hair projecting from the hair line toward the cheek.

G. Other associated anomalies, such as facial clefts and skeletal deformities.

2. *The incomplete form.* In this form the appearance of the palpebral fissure and the lower lids is characteristic, and there is underdevelopment of the malar bones and the mandible. The external ear may be normal, but hearing is often impaired. In this group, to which Treacher Collins'[2] case probably belongs, the syndrome is present but the de-

* From the Section of Ophthalmology, University of Puerto Rico School of Medicine. Presented in part at the VI. Pan-American Congress of Ophthalmology, Carcas, Venezuela.

velopment is less extensive and less striking.

3. *The abortive form.* In this group only the anomalies of the eyelids are present. These abortive cases, according to Duke-Elder,[5] are rare. He could find only three cases in the literature, reported, respectively, by Barry in 1889, by Isakowitz in 1927, and by Schachter in 1947. Franceschetti[4] commented that it is difficult to decide whether some abortive cases represent a pathologic stigma, the so-called forme fruste of the mandibulofacial syndrome, or should be classified in the "borderline of normality."

4. *The unilateral form.* In this group the abnormalities, whatever the degree, are present on only one side of the face.

5. *The atypical forms.* This group includes incomplete forms of the syndrome, in which one of the principal characteristics is missing while other abnormalities, such as microphthalmos, which do not belong in mandibulofacial dysostosis, may be present. According to Franceschetti and Klein,[4] atypical cases may "lead over" to transitional forms which do not show anomalies of the lids and other typical characteristics and which therefore cannot be classified as mandibulofacial dysostosis.

In a number of the reported cases of this syndrome associated anomalies have been described, including distichiasis, dermolipomas of the conjunctiva, skeletal deformities, and such anomalies of the extremities as syndactyly.

Pathogenesis

Ida Mann,[6] in a report of a case of mandibulofacial dysostosis in 1943, discussed in detail the embryologic meaning of this defect. It appears to originate in a defective gene, which results in defective ossification of the bones of the face that are derived from the maxillary (visceral) mesodermal process of the first visceral (mandibular) arch. Probably the inhibitory factor becomes effective about the seventh week of fetal life, when the facial bones are being formed.

Franceschetti and Klein[4] gave a detailed description of how the various malformations typical of the syndrome appear as a result of the maldevelopment of the facial bones, with resulting hypoplasia and malposition of the surrounding soft tissues of the lips, face, and ears. The blind fistula characteristic of the syndrome is explained as the result of a noncoalescence of the first visceral groove. It is chiefly the mandible and malar bones, and, to a lesser degree, the other facial bones that show defective development. Hypoplasia of the malar bones is the principal cause of the antimongoloid obliquity of the palpebral fissure, as well as of the downward droop of the lateral portion of the eyelids, especially the lower lids, and the S-shape of the border of the lower lids. Colobomas of the lids and occasional associated defects of the lashes and the meibomian glands are secondary, in Franceschetti's opinion, to the bony hypoplasia.

Hereditary factor

There is no doubt of the hereditary factor in mandibulofacial dysostosis. Several of the genealogies described in the literature indicate that this syndrome is an independent genotypic entity which follows the irregular dominant form of transmission. It was transmitted in uncomplicated form, without associated anomalies, through three generations in the cases observed by Debusmann[7] in 1940, Leopold, Mahoney and Price[8] in 1945, and Brohm and Kluska[9] in 1947.

The marked variability in the degree of the manifestations observed in the reported cases of mandibulofacial dysostosis, which makes it necessary to divide them into a number of different categories, points to an unstable gene, with variable expression. The degree of penetrance of the defective gene varies in the reported cases from the low-grade penetrance of Debusmann's[7] cases to the high-grade penetrance in the cases reported by Leopold and his associates.[8]

Debusmann's report indicates that the gene may have a lethal effect which increases in severity in successive generations. In the

family that he described, the three children in the last generation, who each presented a fully developed syndrome, died within the first six months of life. The reports of accessory abnormalities, such as anomalies of the vertebral column, the extremities and the thorax, suggest that one is dealing with a pleiotropic (polyphenic) gene.

Allied syndromes

Mandibulofacial dysostosis must be differentiated from two other syndromes, the craniofacial dysostosis of Crouzon and the acrocephalosyndactyly of Apert. In both of these conditions, antimongoloid obliquity of the palpebral fissure and S-shaped lower lids may be present, but the appearance of the head and the facial details are in sharp contrast to the facies of the patient with mandibulofacial dysostosis.

Familial primary hypoplasia of the orbital margin

A new syndrome, described in 1955 by Urrets-Zavalía[10] and termed familial primary hypoplasia of the orbital margin, also must be considered in this connection. Its principal features are:

1. Marked agenesis of the orbital margin.
2. Hypoplasia of the palpebral skin and tarsal plates.
3. A variable developmental defect of the lacrimal passages.

In one of the genealogies reported by Urrets-Zavalía, the defect consisted of a very short inferior canaliculus; ectopia and elongation of the lower punctum; and atresia of the nasolacrimal duct, with a supernumerary canaliculus that opened at the inner canthus. In another genealogy there was a total absence of the lower canaliculus, in conjunction with a shallow, scarcely noticeable colobomatous indentation of the lacrimal portion of the border of the lower lid. A variable amount of hyperopia was frequently present, as well as certain congenital defects of the extraocular muscles.

Urrets-Zavalía explained this malformation as due to a faulty development of the paraxial and visceral mesoderm, which differentiates to form the bones of the upper portion of the face. The abnormalities of the surrounding soft tissues he considered secondary. Hyperopia and insufficiency of some of the extraocular muscles may also be explained by a defective differentiation of the paraxial mesoderm.

The pedigrees of the two affected families showed a dominant type of heredity. The gene demonstrated a highly penetrating character and fairly constant expression. Urrets-Zavalía considered the mode of action of this gene similar to that of the genes held responsible for Crouzon's craniofacial dysostosis; for mandibulofacial dysostosis; and for the deep skeletal and muscular deformities frequently found in association with developmental defects of the external ear. In mandibulofacial dysostosis, Urrets-Zavalía pointed out, the paraxial mesoderm is usually spared, as are also the structures derived from the lateral frontonasal process. For this reason, there is no agenesis of the upper and mesial wall of the orbit in this syndrome, nor are anomalies of the lacrimal ducts usually present.

In Urrets-Zavalía's cases the presence of hypoplasis of the tarsal plates was determined by palpation. In mandibulofacial dysostosis, distichiasis or maldevelopment of the tarsus has been reported in only an occasional case.

Congenital ectropion and distichiasis

Urrets-Zavalía mentioned the possibility that transition forms may occur between the syndrome he described and Franceschetti's syndrome. Both of them seem closely related to a syndrome that I recently described and that I termed congenital ectropion and distichiasis.[11] My report was based on the investigation of a family of 18 members, in three generations. Only five in the family had normal eyes. Eleven of the 18 in the family suffered from congenital ectropion, which in eight instances was associated with

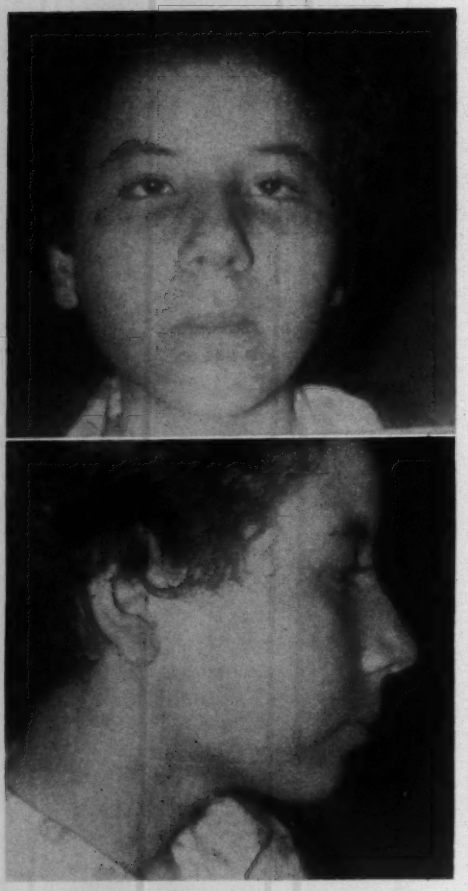

Fig. 1 (Picó). *Case 1.* Full-face and profile views of 13-year-old girl with mandibulofacial dysostosis. Note slight slanting of palpebral fissures and apparent underdevelopment of malar bones and mandible shown by flattening of cheeks and recession of chin.

distichiasis. Two persons had distichiasis alone. Previously reported cases of ectropion, which numbered five at most, lacked many of the characteristics of the anomaly observed in this family. Similarly, reported cases of associated ectropion and distichiasis, which number two at most, lacked other characteristic features of the cases that I reported.

Histologic examination of specimens obtained in two cases in this family showed absence of meibomian glands and either complete absence of the tarsal plate or the presence of only vestigial structures. Absence, weakness, and other defects of the tarsus were determined by palpation in the other cases in my reported genealogy, but a clinical examination, of course, cannot be regarded as conclusive. This special etiologic factor was not investigated in any of the cases of ectropion previously reported.

Other characteristic features of the syndrome of congenital ectropion and distichiasis included narrowing of the palpebral fissure horizontally, which was described by the patients as "small eyes," and vertical shortening of the eyelids.

The mode of inheritance in this congenital syndrome is evidently of the autosomal dominant type. The responsible gene in the series showed a high degree of penetrance; more than half of the members of the family presented one defect or the other or both. The genetic expression, however, was somewhat variable; the degree of ectropion or distichiasis varied widely. On the other hand, there was no doubt of the expression, since, of the 10 living affected members of the family who could be examined, only two showed distichiasis alone. The other eight showed both ectropion and distichiasis.

In the 10 living patients in my series who presented ectropion, the anomaly involved all four lids in four cases and was complete in the lower lids, but less marked in the upper lids, in every case. One patient had complete ectropion of both lower lids, with normal upper lids. The other five patients had only slight ectropion of both lower lids. Ectropion of the upper eyelids is not a feature of mandibulofacial dysostosis.

No bony abnormalities were seen grossly or elicited by palpation in any of these cases. The borders of the orbit were normal, and no obliquity of the palpebral fissures was noted. In this syndrome, the ectropion and distichiasis are evidently the result of a defect of tarsal development and have nothing to do with anomalies of the facial bones.

Vertical shortness of the eyelids is probably also due to a primary deficient development of all the tissues in the eyelids, though perhaps it is secondary to primary absence or deficiency of the tarsus.

The gene responsible for the syndrome of congenital ectropion and distichiasis apparently has an inhibitory effect on the development of the mesodermal and ectodermal components of the tarsus and possibly of the other structures of the lids. For these and other reasons, I believe that it is probably the same gene that produces the Franceschetti syndrome and the Urrets-Zavalía syndrome, but that, for some unknown reason, the phenotypic end-result is different in each instance.

It might be added that slight ectropion has been described in some of the reported cases of mandibulofacial dysostosis, and a few of the cases in my series therefore had to be differentiated from the abortive forms of that syndrome. These particular patients showed the obliquity of the palpebral fissure typical of the Franceschetti syndrome but not part of the syndrome of congenital ectropion and distichiasis.

Case histories

The two cases which follow are both examples of the abortive type (group 3) of the Franceschetti syndrome.

Case 1

A 13-year-old white girl (fig. 1) was first seen December 5, 1956, with a history of esotropia in the right eye since she was four years of age. Examination showed slight slanting of the palpebral fissures; separation of the external canthi from the bulbar conjunctiva; right esotropia of 35 prism diopters; and moderate overaction of the right inferior oblique muscle. Vision was 20/30 in the right eye and 20/20 in the left eye. Flattening of the cheeks and recession of the chin suggested some underdevelopment of the malar bones and the mandible. Roentgenograms of the skull and facial bones failed to reveal any abnormality. The remainder of the ocular examination and the general physical examination were negative.

The familial history in this case was noncontributory.

Fig. 2 (Picó). *Case 2.* Full-face and profile views of six-year-old child with mandibulofacial dysostosis. Note antimongoloid obliquity of palpebral fissures, slight ectropion of temporal fourth of lower lids, their S-shape, and the malar flattening.

Case 2

A six-year-old white boy (fig. 2) was first seen July 3, 1957, with a history of esotropia since he was one year of age. He had twice failed to pass the first grade and his intelligence was regarded as less than normal.

Examination showed slight epicanthus in both eyes. There was an antimongoloid (downward and lateral) obliquity of the palpebral fissures and slight ectropion of the temporal fourth of the lower lids, which were S-shaped. The upper lids were normal, as were the lashes, the openings of the meibomian glands, and the borders of the orbits on palpation. A flattening of the cheeks and some recession of the chin suggested underdevelopment of the malar bones and the mandible. Neither palpation of the

skull and facial bones nor roentgenograms of these areas revealed any abnormalities.

The rest of the ocular examination revealed no additional abnormalities. Examination of the upper and lower jaws, the palate and teeth, the ears, and the bones of the rest of the body also revealed no abnormalities.

The patient's brothers, who were aged four years and seven months, respectively, were also examined, but the only abnormal finding was a slight epicanthus in the older child.

Summary

Mandibulofacial dysostosis is an uncommon condition which was first described by Berry in 1889 but was not definitively described until 1949, by Franceschetti and his associates. The classification includes five categories, namely, complete, incomplete, abortive, unilateral, and atypical. The condition apparently originates in a defective gene, and there is a definite hereditary factor. The syndrome of mandibulofacial dysostosis is apparently genetically related to certain other syndromes, especially familial primary hypoplasia of the orbital margin (Urrets-Zavalía) and congenital ectropion and distichiasis (Picó). Two additional cases are reported, both of the abortive type.

1475 Wilson Avenue.

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EFFECT OF ECHOTHIOPHATE AND AMBENONIUM ON THE RABBIT PUPIL*

Irving H. Leopold, M.D., and Narendra Krishna, M.B.B.S.
Philadelphia, Pennsylvania

Introduction

The agent, 2-diethoxyphosphinylthioethyltrimethylammonium iodide (217-MI; echothiophate iodide; phospholine iodide), is a relatively irreversible inhibitor of acetylcholinesterase[1] and N,N′-bis (2-diethylaminoethyl) oxamide bis-2-chlorobenzyl chloride (WIN 8077; ambenonium chloride; mytelase chloride) a reversible one.[2] Clinically the value of echothiophate has been established amply, ever since its introduction in control of glaucoma by Leopold, Gold

* From the Department of Ophthalmology, Graduate School of Medicine of the University of Pennsylvania and the Research Department of The Wills Eye Hospital.

TABLE 1

SYNERGISM AND ANTAGONISM BETWEEN ECHOTHIOPHATE AND AMBENONIUM IN RABBIT EYES

Control O.D.	Test O.S.	Result
1. 0.25% phospholine 0.1 cc.	5% mytelase 0.1 cc.	Slightly more effective
2. 0.25% phospholine 0.1 cc.	0.25% phospholine 0.05 cc. 15 min. later 5.0% mytelase 0.05 cc.	Slightly more effective
3. 0.25% phospholine 0.1 cc.	5.0% mytelase 0.05 cc. 15 min. later 0.25% phospholine 0.05 cc.	Definitely less effective
4. 0.25% phospholine 0.1 cc.	Mixture of 5% mytelase + 0.25% phospholine 0.1 cc.	Definitely less effective

and Gold,[3] in the management of accommodative esotropia by Miller,[4] and in the treatment of myasthenia gravis by Osserman, Cohen and Genkins,[5] and that of ambenonium by its introduction in the treatment of myasthenia gravis by Schwab, Marshall and Timberlake.[6]

Synergism between the various anticholinesterase agents is sometimes desired in conditions of glaucoma and accommodative esotropia where the use of one anticholinesterase inactivator alone is found to be ineffective or sometimes to be avoided because of the marked cholinergic toxicity that may ensue, as in myasthenia gravis. Marked synergism has been reported between echo-

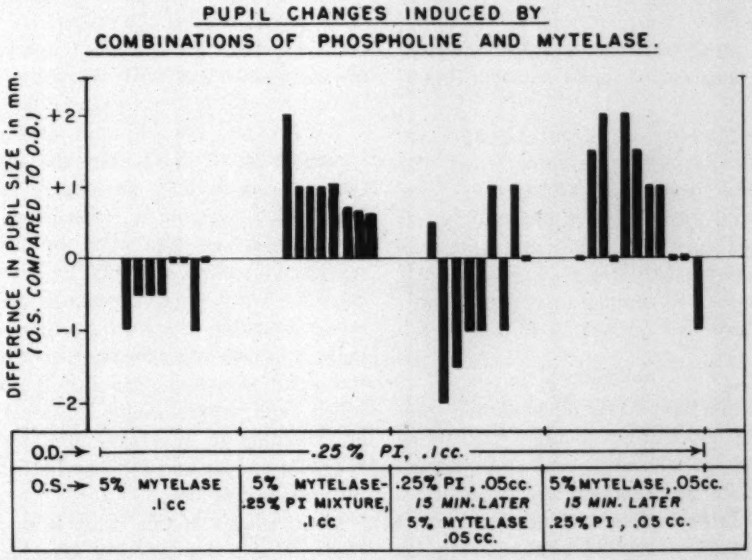

Fig. 1 (Leopold and Krishna). Synergism and antagonism between echothiophate and ambenonium in rabbit eyes. Each bar represents one rabbit.

thiophate and ambenonium.[7] It occurred to us that this synergistic action could be usefully exploited in certain patients with intractable glaucoma and accommodative esotropia in whom the use of echothiophate alone was insufficient to control the condition. Prior to such a use in human subjects, it was considered desirable to see if such a synergism could be demonstrated on the pupillary action of rabbits. Consequently studies were undertaken from this point and the results of these studies are reported here.

Methods and Results

Young albino and pigmented rabbits of either sex and of approximately equal weights were used and eight to 12 rabbits were employed in each experiment. Freshly prepared aqueous solutions of 0.25-percent echothiophate iodide and 5.0-percent ambenonium chloride were employed. Exact amounts of solution were measured by means of a 1.0-cc. microsyringe and delivered directly to the eyes in the form of drops. Care was taken to keep the eyes closed by drawing the two eyelids together for at least one minute after each instillation to attain maximum effect. Observations of the pupillary size were made at repeated intervals over a 48-hour period under constant illumination.

The designs of these experiments and their results are shown in Table 1 and Figure 1. The degree of effectiveness was demonstrated by the earlier onset of miosis and delayed recovery of the pupil to normal size. Onset of miosis was noticeable as early as 15 minutes and complete recovery to normal pupillary size attained in 48 hours.

Comments

We found a 5.0-percent ambenonium solution slightly more effective and a mixture of 5.0-percent ambenonium and 0.25-percent echothiophate solution definitely less effective than the 0.25-percent control solution in most rabbit eyes when applied locally, as far as miosis is concerned. Echothiophate was less effective in eyes treated 15 minutes beforehand with ambenonium than in nonpretreated eyes, which is in agreement with the findings of other workers who have demonstrated both in vitro and vivo, by manometric as well as histochemical techniques, a similar protective action against another irreversible inhibitor of acetylcholinesterase, DFP, by previously administered ambenonium.[2,8] When the order was reversed and ambenonium was given 15 minutes after echothiophate, a greater miosis was obtained as compared with the echothiophate control.

In support of our findings, the previous work of Koster,[9] Leopold and McDonald,[10] and Krishna and Leopold[11] deserves special mention. Koster has demonstrated that cats pretreated with physostigmine are protected against the lethal doses of subsequently administered DFP while the previous administration of DFP results in a long-lasting increase in susceptibility of cats to the lethal action of physostigmine.[9]

Leopold and McDonald have observed that if physostigmine is instilled into a normal human eye and 15 minutes later DFP is instilled in both eyes, the eye that received DFP alone remains constricted for 10 to 14 days, whereas the eye that received both physostigmine and DFP returns to the preinstillation size in two to three days.[10]

Krishna and Leopold have shown that the average time of death after the administration is considerably prolonged in rabbits when physostigmine is given prior to DFP or echothiophate than when the order is reversed. This blocking action is, however, not observed when physostigmine is given prior to demecarium, the average time of death being approximately the same irrespective of the order of administration.[11] It may be recalled that physostigmine, demecarium and ambenonium are reversible inhibitors of acetylcholinesterase and DFP and echothiophate the irreversible ones.

On the basis of this study it may be concluded that a combination of echothiophate and ambenonium not only offers no addi-

tional advantage over the use of each drug alone but also may prove antagonistic, depending upon the order of administration, as far as miosis is concerned.

Summary

Synergism and antagonism between 0.25-percent echothiophate iodide and 5.0-percent ambenonium chloride were studied on the rabbit pupil. Instillation of ambenonium alone was found to be slightly more rapidly effective and mixture of ambenonium and phospholine less effective than echothiophate alone. As compared to eyes treated with echothiophate alone miosis was slightly increased with ambenonium in eyes previously treated with echothiophate but was definitely retarded when the order was reversed.

1601 Spring Garden Street (30).

Acknowledgment

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THE HISTOLOGIC STRUCTURE OF THE CHAMBER ANGLE IN PRIMATES*

Johannes Rohen, M.D.
Mainz, Germany

Great differences exist in the structure of the chamber angle between other mammals and man.[6,9] In such laboratory animals as rodentia, carnivora or ungulata, the ciliary body is divided in two parts, as pointed out by Lauber.[4] The posterior part contains the ciliary muscle, whereas most of the tissues which play a role in aqueous filtration and iris fixation are in the anterior part. The iris is attached to the cornea by a large number of strands which form the pectinate liga-

* From the Department of Ophthalmology and the Oscar Johnson Institute, Washington University, School of Medicine, Saint Louis, Missouri. This investigation was supported in part by the Fight for Sight Fellowship No. 137 of the National Council to Combat Blindness.

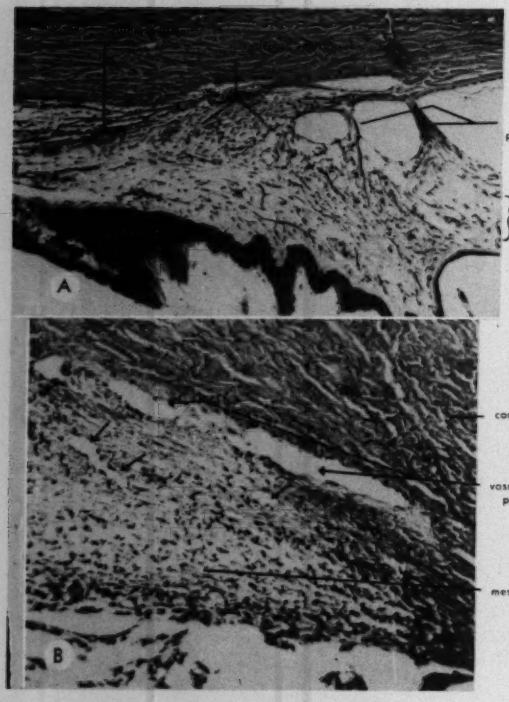

Fig. 1 (Rohen). Sagittal sections of the chamber angle. (A) Rabbit eye (×98, Goldner's trichrome staining). The chamber angle shows a division in two parts as it is seen in lower monkeys also. The iris is attached mostly to the corneosclera, and the meshwork is still undeveloped ("reticular"). Note the absence of Schlemm's canal. (B) Cross section of the "reticular" meshwork in the chamber angle in a goat eye. Note the intra-uveal loops of capillary vessels, coming down from the scleral plexus (arrows). The meshwork has a structure like reticular connective tissue with a cell "syncytium," argyrophil fibers (mostly seen here in cross sections), and a homogeneous ground substance between the cellular network. Uveal meshwork below, sclera on top.

ment. The anterior part of the ciliary body shows a reticular structure with large Fontana's spaces.

In these animals, the so-called trabecular meshwork is not comparable morphologically to the related structure in human eyes. It consists of a cellular meshwork of embryologiclike connective tissue, similar to the "syncytium" found in lymphatic nodules, bone-marrow or spleen (fig. 1). At the filtration area inside the sclera, a large plexus of small capillaries is observed. Occasionally, they loop within the meshwork but do not appear to communicate with the uveal vessels (fig. 1-B).

In contrast to this situation, the filtration angle of man reveals a highly differentiated structure. The trabecular meshwork consists of a complicated system of lamellae, each demonstrating different layers of various substances and fibers covered by endothelial cells. In addition, different areas within the trabecular meshwork can be distinguished, and a Schlemm's canal is present. Thus, the question arose whether these differences develop little by little during the evolutionary process or suddenly without transition.

Eyeballs of different species of primates were collected for histologic examinations. At present the material studied consists of eyes of most families in lower and higher monkeys. The italicized items in Table 1 designate the genera investigated. The histologic appearance of the chamber angle reveals a gradual transition from lower developed structures as seen in some mammals to higher developed structures as seen in man. The present paper describes the probable evolutionary process of the chamber angle in the eyes of primates.

Material and Methods

The material used consisted of eyes taken from species which are in italics in Table 1.

These eyes were cut mostly in cross-section but, in addition, tangential or frontal sections were also made. Histologic and histochemical stains included Heidenhains Azan, trichromstain (Masson-Goldner), periodic-acid-Schiff (PAS), alcian blue, colloidal-iron-stain (Ritter-Oleson), Heidenhains iron-hematoxylin and others.

Findings

The lowest primate used was the tree-shrew, Tupaia, no bigger than a squirrel. This is a small, smart, diural animal. It shows a highly developed all-cone retina with differentiated and well-separated layers, as well as special retinal vessels and other signs of higher development. However, the chamber angle and the accommodative system exhibit features of lower development. The ciliary muscle is small and inserts far behind the point where the iris processes attach to the chamber angle (fig. 2). Therefore, the angle appears relatively deep and filled with large Fontana's spaces and an undeveloped meshwork of reticular tissue. In this way, the structure of the angle is very similar to that of such mammals as rabbits, cattle, and so forth.

Because of the fact that the iris is fixed to the cornea and sclera by the well-developed pectinate ligament, the connection between the ciliary body and the iris is small and the anterior part of the ciliary body is filled by a wide reticular tissue with large Fontana's spaces in between. The so-called trabecular meshwork is morphologically not

TABLE 1

EYES WERE TAKEN FROM SPECIES IN ITALICS

Suborder	Infraorder	Family	Genus
Prosimiae	Tupaiformes	Tupaiinae	*Tupaia*
	Lemuriformes	Ptilocercinae	Ptilocercus
		Lemurinae	*Lemur* Hapalemur
		Cheirogaleinae	Cheirogaleus Microcebus
		Indriinae	Avahi Indri Propithecus
	Lorisiformes	Lorisidae	*Loris* *Nycticebus* *Perodicticus*
		Galagidae	*Galago*
Simiae	Platyrrhina	Cebidae	*Aotes*— Nyctipithecus *Alouatta* *Cebus* *Saimiri* *Ateles*
		Callithricidae	*Leontocebus* Tamarin
	Catarrhina	Cercopithecidae	*Macacus* (rhesus) *Papio* Cercocebus *Cercopithecus* *Erythrocebus*
			Presbytis Colobus
	Hominodea	Hylobatidae	*Hylobates*
		Pongidae	*Orang* *Chimpanzee* *Gorilla*
		Hominidae	*Homo*

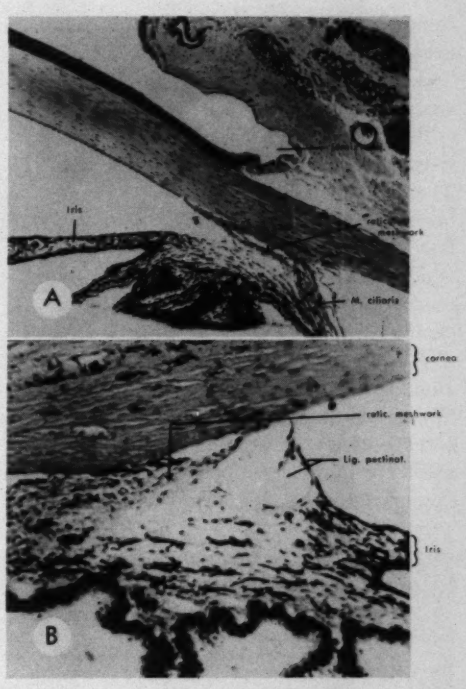

Fig. 2 (Rohen). Sagittal sections through the eye of the most primitive monkey. Tupaia glis (Haidenheins Azan staining). (A) × 100 and (B) ×250. Note the depth of the chamber angle, the division of the ciliary body in two parts, the small ciliary muscle and the undeveloped "reticular" meshwork. A Schlemm's canal is absent.

comparable to the related structure in human eyes. It consists of a cellular network like a "syncytium" of embryologic connective tissue.

Between the cells is a fibrous tissue consisting of thin, argyrophil or reticulin fibrils. The main direction of these fiber bundles is horizontally or equatorially orientated. The fibrils are imbedded in a ground-substance, which shows a high concentration of soluble mucopolysaccharides. This is usually not demonstrable in routine paraffin sections.

The structural condition of the chamber angle of the lowest primates changes gradually as we ascend the evolutionary series to a morphology resembling that visualized in man. The more developed the accommodation system, the more the chamber angle changes structurally. Figure 3 shows the angle of the lower primate, Nycticebus, one of the Lorisidae, in the groups of Prosimiae (fig. 3). The similarity to the other mammals, for instance, rodentia, ungulata and so forth, is striking: big pectinate ligament, large Fontana's spaces, division of the ciliary body in two parts, undeveloped "reticular" meshwork and the extended filtration area in contrast to a Schlemm's canal as present in man. It can be seen that the ciliary muscle consists only of small muscle bundles with much interspersed connective tissue. The weak accommodation system of these animals may be related to the fact that they are nocturnal. In addition many species have a tapetum lucidum within the choroid, like cats.

Among the Galago families of the Lorisi-

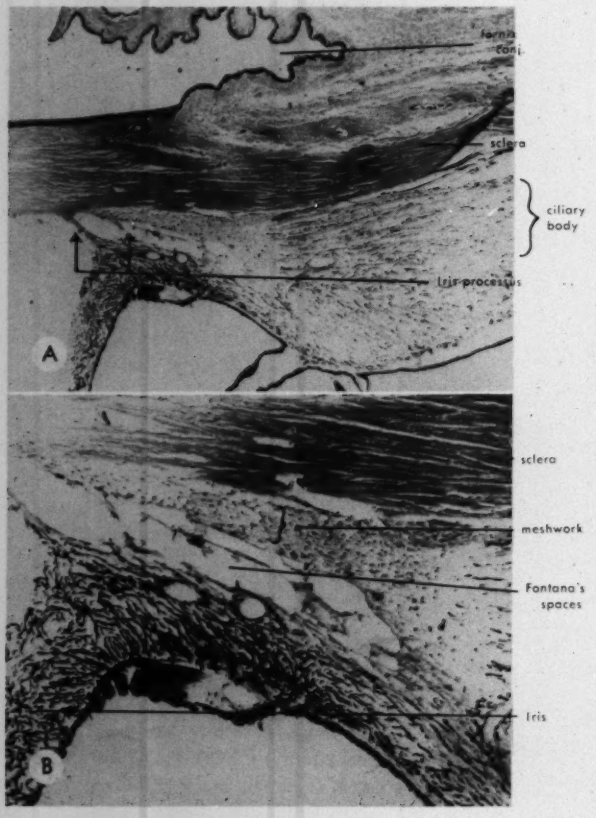

Fig. 3 (Rohen). Sagittal sections of the chamber angle in Nycticebus, (Lorisidae, Prosimiae). (A) ×40 and (B) ×100. Trichrome stain by Masson-Goldner. Note the large pectinate ligament, the attachment of the iris to the cornea, the wide Fontana's spaces, and the undeveloped "reticular" meshwork for the aqueous filtration. It is not comparable with the trabecular meshwork in higher primates and man.

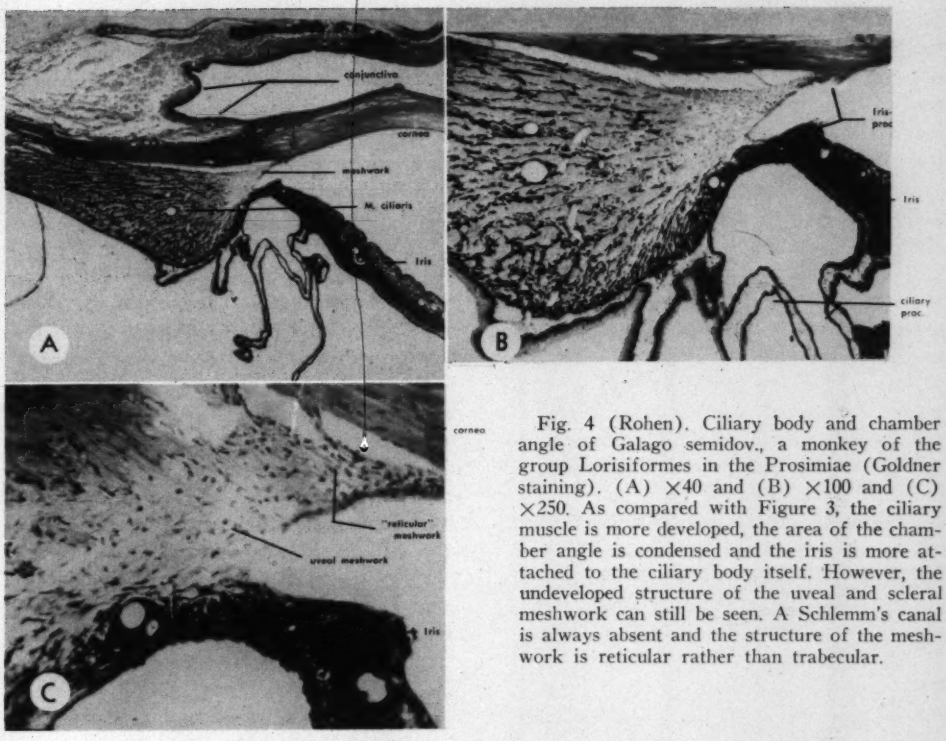

Fig. 4 (Rohen). Ciliary body and chamber angle of Galago semidov., a monkey of the group Lorisiformes in the Prosimiae (Goldner staining). (A) ×40 and (B) ×100 and (C) ×250. As compared with Figure 3, the ciliary muscle is more developed, the area of the chamber angle is condensed and the iris is more attached to the ciliary body itself. However, the undeveloped structure of the uveal and scleral meshwork can still be seen. A Schlemm's canal is always absent and the structure of the meshwork is reticular rather than trabecular.

formes (fig. 4) a well-developed ciliary muscle and more delineated chamber angle are found. The pectinate ligament consists of only a few strands. The iris processes fuse into the ciliary body, and the Fontana's spaces disappear almost completely. However, the meshwork provides a much smaller area for aqueous filtration and exhibits the same undeveloped and reticular structure as seen in the lower monkeys. Histologically there is no indication of the development of a lamellar structure of the meshwork or a Schlemm's canal with differentiated filtration zone on the inner wall, as found in human eyes. However, the area provided for the aqueous filtration is relatively more concentrated in these eyes than it is the case in other Prosimiae (table 1).

The situation changes during transition from Prosimiae to Simiae. Among the New World monkeys (Ceboidae), there are many species with a chamber angle very similar to man. Figure 5 demonstrates the anatomic structure of the angle from two different species of Cebidae (long-tailed monkeys), namely Cebus and Ateles. It is obvious that the connective tissue of the uveal meshwork in the angle is much reduced. The so-called scleral meshwork is apparently more a real trabecula of several lamellae. A true Schlemm's canal, a scleral spur and the special feature of attachment of the ciliary muscle to the meshwork and cornea are visible. Now the chamber angle resembles that in human eyes. The trabecular meshwork shows the same lamellar structure as in man. It is equipped with "glass-membranes" covered by endothelial cells and a special "inner wall" of Schlemm's canal. The pectinate ligament appears reduced to small strands of tissue, sometimes completely absent. In the eyes of many other species of primates, like Marmo-

set, Macacus, Rhesus, Papio, Cercocebus, Cercopithecus, Erythrocebus and the Pongidae (Chimpanzee, Gorilla, and so forth) one finds almost the same chamber angle as in man. However, special variations exist within the different species and families.

It is interesting to see that the first group among the New World monkeys (Ceboidae), for example, Aotes or Nyctipithecus, is equipped with a completely differentiated structure in the chamber angle (fig. 6). However, the greater amount of connective tissue in front of the ciliary muscle, the relatively undeveloped reticular structure of the meshwork, the absence of the lamellae and differentiated trabeculae, the scattered ground substances between them and the "syncytial" network of endothelial cells, exhibit characteristics of lower primates (compare with some Lori or Galago species). The Aotes are interesting animals, which belong to the Simiae, but have reverted in several aspects of behavior and structure to the lower forms of monkeys. It leads a nocturnal life, has no macula or fovea centralis (Kolmer[3]) and has many other structures in the eye, remnants of lower evolutionary forms.

Macacus rhesus, often used in experiments, belongs to the Old World monkeys, the Cercopithecidae. The structure of its angle is similar to that of Ateles, as demonstrated in Figure 5-B. In comparison to man, the trabecular meshwork is finer, the diameter of a single trabecula seems to be smaller, the "glass membranes" covering the trabeculae are thinner, and the endothelial cells are more numerous, especially in the region of the inner wall with reference to Schlemm's

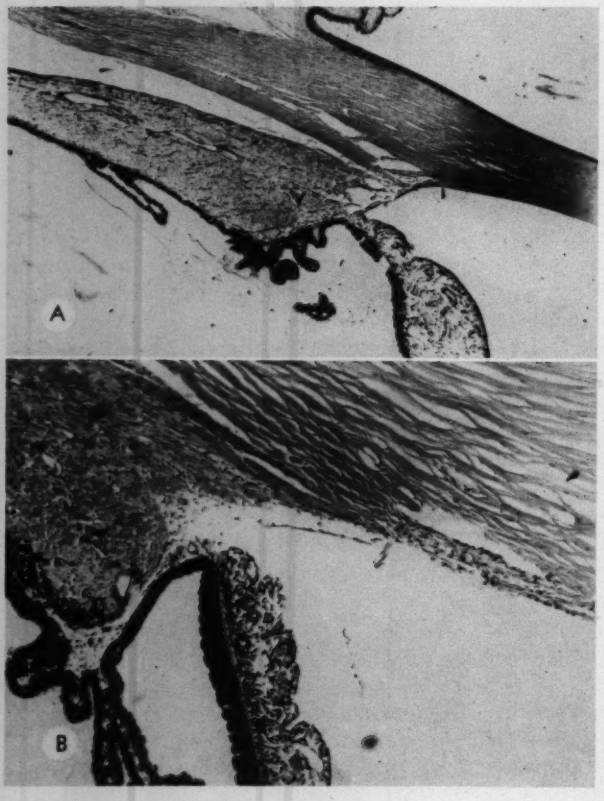

Fig. 5 (Rohen). Cross sections of the eye from two genus of Cebidae. (A) Cebus, ×40, hematoxylin-eosin. (B) Ateles, ×100, Goldner staining. In comparison with the structure of the chamber angle in Prosimiae (figs. 3 and 4), the Cebidae show for the first time a lamellar or trabecular meshwork in the angle. The uveal meshwork is mostly reduced and the iris root points over the ciliary body. Now, Schlemm's canal has developed and the pectinate ligament is partly absent.

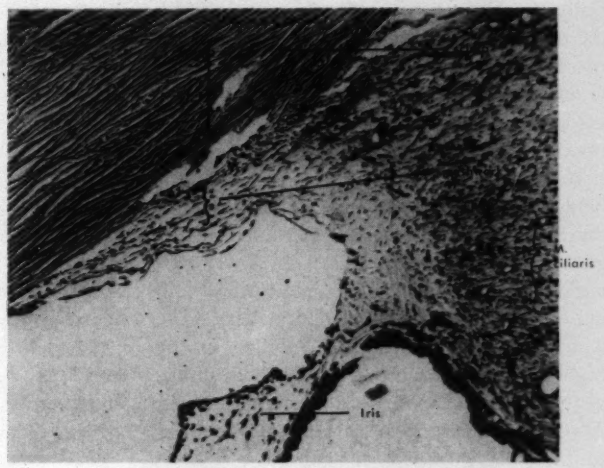

Fig. 6. (Rohen). Sagittal sections of the chamber angle in Aotes or Nyctipithecus. (×100, Goldner staining.) Note the reduction of the chamber area with Schlemm's canal, meshwork formation, and so forth. However, the meshwork is still reticular and not trabecular as in other relatives of this group. Aotes is, therefore, a special example within the group of Simiae.

canal. In principle, however, there is no difference in the structure of the trabecular meshwork as compared to man.

Similar findings are seen in other groups of higher primates, especially in long-tailed monkeys and the Pongidae (Chimpanzee, Gorilla, Orang, and so forth). Hence, the essential steps in the evolution of the chamber angle seem to occur mostly in the lower groups of monkeys, especially during the transition from Prosimiae to Simiae.

Discussion

Some general statements about the anatomic configuration of the chamber angle in primates, especially about the relationship between form or shape of the eyeball and the structure of the anterior chamber, have been made by Detwiler,[2] Rochon-Duvigneaud[5] and Lauber.[4] An extensive histologic and histochemical study of the various groups of tissues in the chamber angle and its evolutionary development in primates has not been reported. Troncoso and Castroviejo[10] investigated the angle of Macacus rhesus and Chimpanzee, using gonioscopic techniques in vitro and came to similar conclusions about the evolutionary process discussed in this paper. They measured gonioscopically the distance between the end of Descemet's membrane and the anterior end of the suprachoroidal space in various mammals. They found that the meridional length between these points became progressively reduced during the evolution from lower mammals to monkey to man.

Surveying the structural changes in the different tissue groups which surround the chamber angle in lower and higher monkeys as well as in man, the process of evolution in this region of the eye can be described by considering five significant points:

1. The angle becomes more and more narrowed and condensed in the course of evolution. In such mammals as the commonly used laboratory animals, and in lower primates (Prosimiae), the aqueous humor passes through the ciliary body. This is facilitated by the small ciliary muscle which is attached to the sclera far behind the end of Descemet's membrane. This way, the ciliary body is divided into two parts: the anterior part contains aqueous with special tissues for filtration (meshwork, and so forth) and the peripheral fixation of the iris (pectinate ligament). In the higher primates, beginning with the Cebidae (Aotes, Cebus, Ateles, and so forth), the accommodation power grows. Therefore, the ciliary muscle increases and the division of the ciliary body and espe-

cially the Fontana's spaces disappear. Thus, the aqueous flow no longer occurs through the ciliary body. The aqueous now passes in front of it before it enters the newly developed trabecular meshwork and Schlemm's canal.

2. In this evolutionary process the pectinate ligament, as the tissue which provides the fixation of the iris root to the cornea, is gradually reduced in volume. In lower primates, like Lorisidae, Tupaiidae, there still exist big strands, so-called iris processes, which become smaller and smaller in the higher developed monkeys and which disappear almost completely in several species. Thus the whole area of uveal tissue in front of the ciliary muscle is reduced and Fontana's spaces are diminuted.

3. The area for the aqueous filtration inside of the corneosclera becomes smaller and smaller during the course of evolution. This, perhaps, may help to explain the important changes in the structure of the meshwork itself which take place during the process of differentiation of the filtration angle. The lower primates and mammals commonly used in the laboratory do not show a real trabecular meshwork. As Figure 1 demonstrates, they have only an undeveloped "reticular" connective tissue. This is often incorrectly called "trabecular meshwork," although it does not bear any histologic similarity to the comparable structure in the human eye. Because of its reticular structure, the term "reticular meshwork" seems preferable, reserving "trabecular meshwork" for primates.

The first steps of evolution concern the concentration of the angle, the increase of accommodation and the reduction of the pectinate ligament which becomes smaller

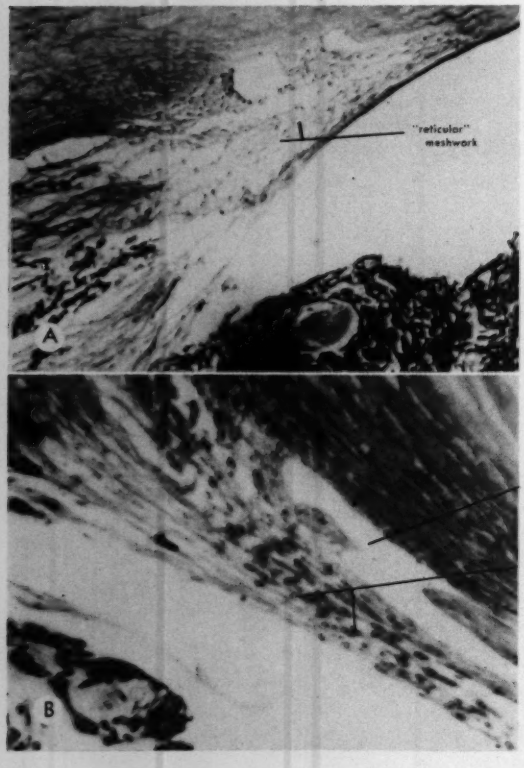

Fig. 7. (Rohen). Sagittal sections of the chamber angle in one lower and one higher developed monkey after PAS staining. (A), Perodicticus of the Lorisidae, ×160. (B) Gorilla of Pongidae, ×320. In the "reticular" meshwork of the lower monkeys (A), the mucopolysaccharides are distributed diffusely between the meshwork (here mostly dissolved, because of the paraffin technique). In the "trabecular" meshwork of the higher primates and man, the mucopolysaccharides are concentrated in the lamellae of the trabeculae, especially in the so-called "glass membranes." The homogeneous ground substance has disappeared. The meshwork is now higher and more condensed than in Prosimae monkeys.

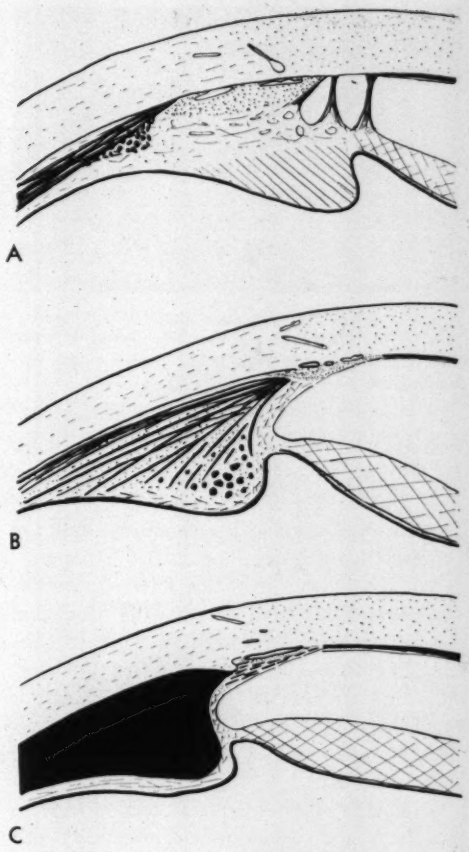

Fig. 8. (Rohen). Schematic drawings from the chamber angle of monkey eyes in order to demonstrate the main steps in the evolutionary process of the angle in primates. (A) Structure of the chamber angle in the lowest developed monkeys (Tupaia, and so forth). Notice the division of the ciliary body, the big pectinate ligament, the small ciliary muscle, which already reveals a small portion of circular fibers. The filtration tissue is still "reticular" and large Fontana's spaces are present. (B) Structure of the chamber angle in Prosimiae (Lorisiformes and so forth). The filtration area appears more condensed, the ciliary muscle larger and the uveal tissue reduced. The iris is now attached more to the ciliary body. The big pectinate ligament has almost completely disappeared. The meshwork, however, appears still "reticular" and incompletely differentiated. (C) Structure of the chamber angle in Simiae and man. Notice the differentiation of the meshwork which now should be called "trabecular." Note also the formation of Schlemm's canal and the further reduction of the uveal meshwork. The ciliary muscle is now completely developed. The iris root is very thin in more highly developed primates.

without any indication of special differentiation. In the higher primates (Simiae), however, beginning with the Cebidae, a new special tissue occurs more or less correctly called "trabecular meshwork" because of its lamellar structure and the peculiar pattern of the endothelial cells and the newly developed homogenous "glass membranes" which cover each individual trabecular lamella between a special tissue core and the endothelial cells. It seems as if the described condensation in the structure of the angle not only takes place as a quantitative process but also as a qualitative one. Hence, the meshwork of the lower primates shows histochemical evidence of a diffuse distribution of mucopolysaccharides, particularly between the network of cells within the ground substances. In the higher primates, however, these substances are found much more concentrated. They form lamellar sheets which are know as "glass membranes" on the trabeculae (compare fig. 7-A and B). These "glass membranes" together with the highly developed structure of the trabecular meshwork itself are only found in Simiae and not in other animals.

It is conceivable that the process of diminution of the filtration area within the sclera was followed by a differentiation process in the meshwork, especially with regard to the mucopolysaccharides. It is conceivable that these structural changes in the trabecular meshwork have functional coun-

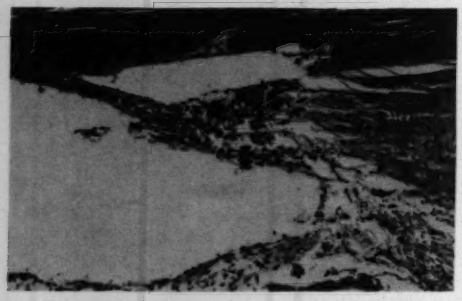

Fig. 9 (Rohen). Chamber angle of Cercopithecus (×92). Note the incidentally found pigment phagocytosis in the endothelial cells of the trabecular meshwork.

terparts. At the present, however, there are no findings to support such an assumption.

4. During the evolutionary process, the structural changes in the chamber angle are followed by the development of Schlemm's canal. The lower primates have no similar structure. They have only a wide plexus on the filtration area endowed with special capillarylike loops of vessels. After the condensation process of the angle, Schlemm's canal develops in a small area (sulcus sclerae) seen first in the group of Cebinae (figs. 5 and 6).

5. Finally, the endothelial cells change in structure and behavior concurrently with the differentiation of the trabecular meshwork. They form lamellae, they produce "glass membranes" and develop special tissue formations at the inner wall of Schlemm's canal. In higher monkeys, one often finds phagocytosis of pigment granules within these cells, seldom to a degree as is demonstrated in Figure 9. This means that these cells are endowed with phagocytic abilities like reticulo-endothelial cells in other places of the body. The general changes in the structure of the chamber angle of primates during the described evolutionary process is schematically summarized in Figure 8.

Summary

The tissue structure in the chamber angle differs significantly between various groups of mammalia used in the laboratory, monkeys and man. By comparison of the angle structures in mammals and lower and higher monkeys, a special process of evolution can be described. This process concerns the concentration of structures in the region of the filtration angle and is associated with an increase in differentiation of the accommodative system, especially the ciliary muscle, and a reduction of the pectinate ligament and uveal meshwork. The Fontana's spaces disappear gradually and Schlemm's canal develops. A true lamellar or "trabecular" meshwork is first seen in the lowest Simiae, the Cebinae (except Aotes or Nyctipithecus). This meshwork shows glass membranes, an organized cell-system, and a highly differentiated connective tissue which is absent in such lower monkeys as Lorisiformes, Lemuriformes or Tupaiaformes. The same differences are observed with regard to the distribution of special substances (mucopolysaccharides) and the endothelial cells of this region. Because of the primitive structure of the meshwork in the lower primates (Prosimiae) and mammals some special term, such as "reticular meshwork" should be used in contrast to the "trabecular meshwork" of higher monkeys and man.

Anatomisches Institut der Universitaet.

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RHEOLOGY OF THE HUMAN SCLERA*

1. Anelastic behavior

Roger St. Helen, A.B., and W. K. McEwen, Ph.D.
San Francisco, California

Introduction

It is well known that the scleral rigidity $(\frac{\Delta P}{\Delta V})$ of an eye changes with pressure. Most scleral rigidity studies have attempted to find the exact relation between scleral rigidity and pressure. It is less well known that scleral rigidity also changes with time after any distention of the eye. A few investigators have hinted at the presence of "creep" or relaxation of tension. Perkins,[1] in particular, called attention to the slow approach to equilibrium of stretched scleral strips. These hints and observations, together with indications from other work in this laboratory, suggested that an analysis of the time dependent behavior of the sclera would be useful.

This paper is presented to show that the human sclera shows anelastic behavior, the rheologic term[2] for the time dependency of scleral rigidity changes.

Materials and Methods

The test chamber consists of a section of lucite rod drilled to form a cup closed at one end and beveled at the other. The I.D. is 1.27 cm. and the average depth is 4.75 cm. to give a volume of about 6.0 ml. An annular ring with a corresponding bevel clamps the section of material under study between the two beveled surfaces. Clamping pressure is applied between two metal plates by means of screws. A microburet (Micro-Metric Instrument Co.) and a pressure transducer (Statham P23BB) are connected to the chamber by polyethylene tubing and needles cemented into the closed end of the chamber. A manometer for calibration is connected to the pressure transducer. A diagram of the apparatus is shown in Figure 1. Figure 2 is a photograph of the chamber and some of the accessory equipment.

The rigidity of the chamber tubing and pressure gage is determined by clamping a solid cap on the open end of the chamber. The rigidity is 11.2 mm. Hg/μl., is linear at least up to 50 mm. Hg, and is called the chamber rigidity. When two pieces of rubber membrane (each 0.003 inches thick) are tested in the chamber they give a rigidity of 0.45 mm. Hg/μl., which is linear between 12 and 40 mm. Hg. Below 12 mm. Hg the rigidity factor falls rapidly.

Normal eyes were obtained from the eye-bank and were tested from one-half to 15 days post mortem, being kept in a humid atmosphere until used. The ages of the donors varied from 33 to 65 years. The eye was trimmed of loose tissue and a section cut between the limbus and the optic nerve. This section was then placed either on the oil layer (liquid petrolatum) or on the

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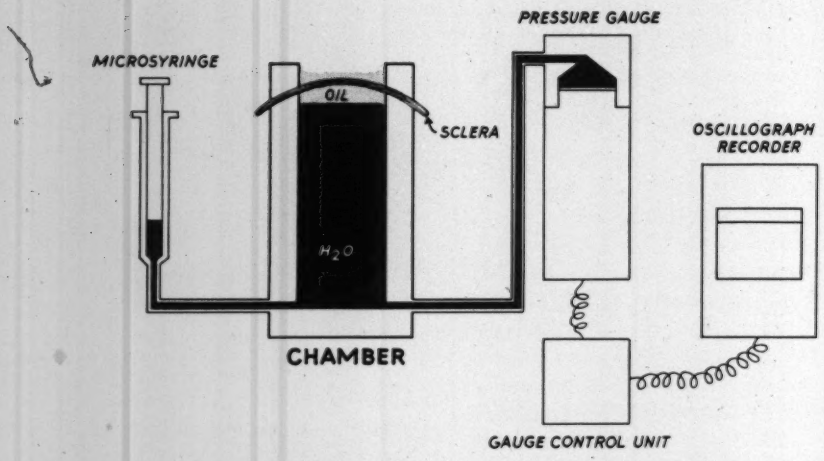

Fig. 1 (St. Helen and McEwen). Diagram of test chamber.

rubber membrane of the water-filled chamber. If rubber was the inner layer, another rubber membrane was placed over the sclera. The annular ring was then placed over the sclera or rubber-sclera sandwich, the chamber was assembled between the metal plates and the screws tightened. If the oil technique was used, a layer of oil was placed on top of the sclera bounded by the annular ring. The sclera should be isolated from the water in the chamber and from air or water at the outside surface in order to obtain a stable base line. Rubber or oil layers on both sides of the sclera prevent exchange of water with the tissue. Apparently, as will be seen later, oil slowly penetrates the tissue.

The system was allowed to equilibrate with an open manometer at 12 mm. Hg, making

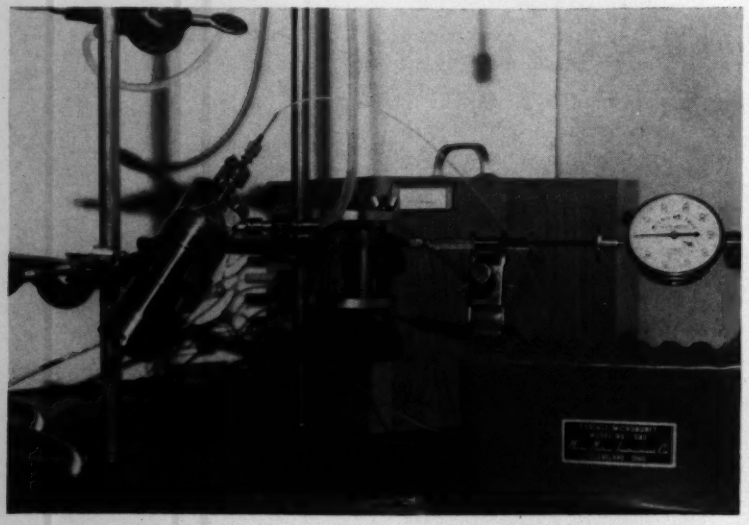

Fig. 2 (St. Helen and McEwen). Photograph of apparatus for testing sclera.

sure that there was sufficient clamping pressure to avoid leaks. A leak is evident by a fall in pressure with the system closed.

The protocols of the individual runs were governed largely by the conditions obtaining in tonography. After a steady base-line was obtained at 12 mm. Hg, sufficient fluid was injected by the microburet to raise the pressure to about 27 mm. Hg, the pressure which would be obtained by placing a tonometer on an eye with a P_o of 12 mm. Hg. The increased pressure was allowed to remain for four minutes, the usual period of a tonographic run. Other permutations of pressure rise and period of increased pressure were also used to cover larger ranges of from 18 to 39 mm. Hg and from four minutes to 30 minutes. Injections of fluid were made rapidly to mimic the rapid pressure rise when a tonometer is placed on the eye. The equilibrium pressure was arbitrarily fixed as 12 mm. Hg for comparative purposes and slightly lower than a normal eye to give a sufficient upward range without encountering excessive pressures.

Results

To illustrate the phenomenon under investigation, the reactions of a rubber membrane and of sclera may be compared. Rubber represents a simple elastic system while the sclera is complex. Two rubber membranes may be clamped in the test chamber, as shown in Figure 1, in place of the sclera. After a two-minute period at a pressure of 12 mm. Hg to establish a base-line, 35 µl. of fluid are injected into the chamber. The pressure rises to 28 mm. Hg and that pressure may be maintained indefinitely. If, after four minutes, the 35 µl. are withdrawn, the pressure returns to the base-line and remains there. If a section of sclera is now inserted between the two rubber membranes, there are obvious differences when the same cycle of events takes place as shown in Figure 3. Now a 7.0 µl. injection of fluid raises the pressure to 28.2 mm. Hg. This pressure does not remain constant but falls in an exponential manner. If, at the end of four minutes, the 7.0 µl. are withdrawn the pressure falls below the base line and then tends to regain its base-line pressure, again in an exponential manner.

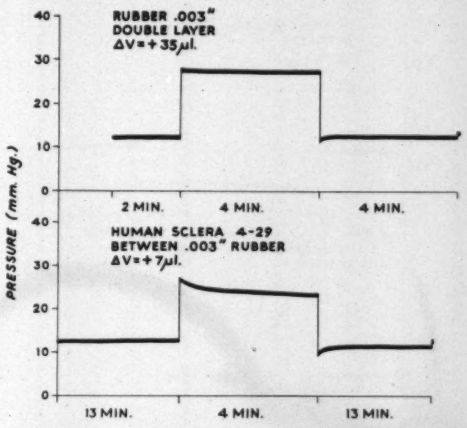

Fig. 3 (St. Helen and McEwen). Reaction of rubber (upper tracing) and sclera (lower tracing) to an initial increase in fluid volume of chamber followed by a subsequent withdrawal of the same amount.

This qualitative reaction of the sclera to changes in strain has occurred with all the scleras that have been tested. It appears to be a reproducible and predictable phenomenon and occurs either between rubber or paraffin-oil layers and whether the initial change is a withdrawal or the changes are cycled as shown in Figure 4. It will be noted that there is a small displacement of the final pressure from the base-line pressure. Usually there is an undershoot if the final pressure is returning from a lower pressure and an overshoot when returning from a higher pressure. This "nonreturn" is a function of the sclera and is not because of a leak in the system. It should be noted that the pressure fall is due to lessened tension in the sclera and not because of a volume change in the whole chamber.

The relaxation of the sclera under constant distention is not a unique reaction but occurs in other tissues[2] and in plastic membranes such as polyvinyl chloride.[3] This

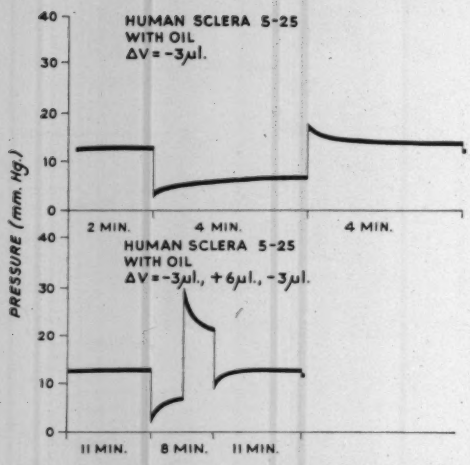

Fig. 4 (St. Helen and McEwen). Reaction of sclera to (a) an initial aspiration of fluid from the chamber followed by a subsequent injection of the same volume (upper tracing) and (b) cycling of volume changes (lower tracing).

action has been called anelasticity[3] or elastic after-effects.[2] It is apparent that the elastic behavior of rubber or of a spring is too simple to explain the complicated rheologic behavior of biologic tissues.

Quantitative analysis

Thirty-four scleral curves have been analyzed on the basis of their anelastic behavior during the first four minutes after the application of a constant strain. In additional four traces have been analyzed over a 30-minute period and include both the relaxation to an applied strain and the recovery from removal of the applied strain. The method in both cases is essentially the same and is illustrated in Figure 5. The pressure resulting from the application of a constant strain produced by the injection of a given quantity of fluid is plotted on semilogarithmic paper against time. This curve is then corrected for the rigidity of the chamber (pressure transducer and tubing) alone. It will be seen that as the pressure falls in the system, the pressure transducer has less of a bulge and the volume displaced from the gage distends the sclera opposing its relaxing

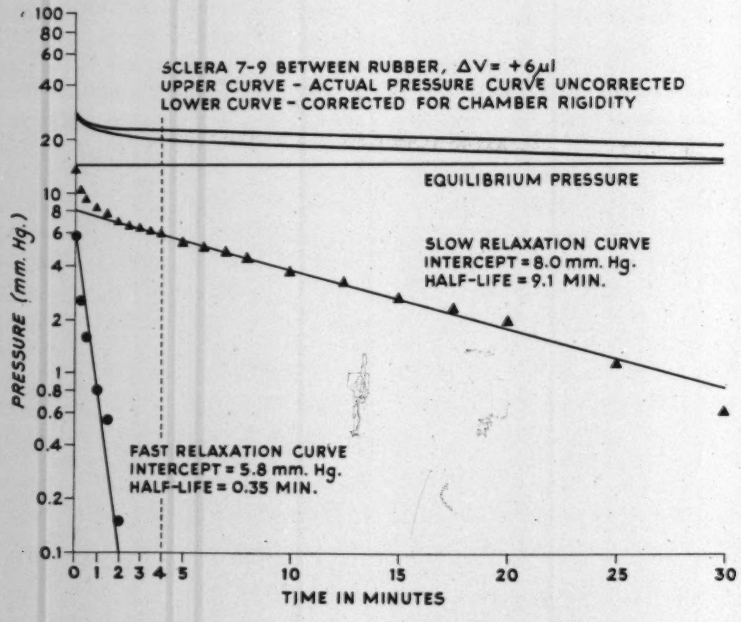

Fig. 5 (St. Helen and McEwen). Method of curve analysis.

TABLE 1

SCLERAL DATA*

Sclera	Days PM	ΔV μl	P_i	K_i	K_{eq}	K_s	$L_s^{1/2}$ min.	K_f	$L_f^{1/2}$ min.
E_1	8	6	26.4	3.1	1.5	0.8	1.3	0.8	0.10
	9	5	27.2	4.1	2.1	0.9	1.9	1.1	0.16
E_2	7	5	27.1	4.1	2.0	1.3	1.9	0.8	0.11
C	4	8	27.8	2.4	1.4	0.7	1.7	0.3	0.09
	4	8	26.7	2.2	1.2	0.7	2.8	0.3	0.08
	5	8	29.0	2.6	1.7	0.6	1.3	0.3	0.09
	5	8	29.4	2.7	1.6	0.6	2.2	0.5	0.13
	5	6	24.4	2.6	1.7	0.6	0.9	0.3	0.06
	5	7	26.8	2.6	1.7	0.6	1.1	0.3	0.08
	5	7	26.3	2.5	1.5	0.7	2.3	0.3	0.08
	8	7	27.3	2.7	1.6	0.8	1.7	0.3	0.06
D_1	1	10	27.3	1.7	1.2	0.4	2.1	0.1	0.08
	2	10	26.3	1.6	1.0	0.5	2.0	0.1	0.06
	3	10	36.4	3.1	0.7	1.3	1.9	1.1	0.13
	3	8	32.6	3.4	1.0	1.4	1.9	1.0	0.12
	3	6	27.6	3.4	1.4	1.2	2.4	0.8	0.13
	3	4	21.8	3.2	1.2	1.5	2.5	0.5	0.07
	3	2	17.0	3.2	2.1	0.8	0.7	0.3	0.04
D_2	15	8	26.5	2.1	1.6	0.4	1.7	0.1	0.06
G_1	1	3	18.9	2.9	1.5	0.8	1.3	0.6	0.06
	1	6	28.3	3.6	1.7	1.2	1.4	0.7	0.08
	½	7	28.2	2.9	1.3	1.0	1.2	0.6	0.08
	1	9	39.2	4.1	1.8	1.5	1.5	0.8	0.09

* Between rubber membranes (each 0.003 in. thick), calculated on a four min. basis. $P_0 = 12$ mm. Hg. Values corrected for chamber rigidity. Ages of donors of scleras C, D, E and G were 64, 65, 53 and 33 years, respectively.

effect on the pressure. The corrected pressure curve referred to the sclera is therefore lower than the actual gage pressure. The correction is made on the basis of the total K for ease in computation and the slight "correction of the correction" for actual K at any given time is neglected. The corrected curve is then drawn, as shown in Figure 5.

The equilibrium pressure, which is usually reached at the end of 30 minutes, is then subtracted from the corrected curve to yield a third series of points. These points tend to describe a straight line except during the first minute or two. A line is then drawn by inspection to fit the latter points and is extrapolated to zero time. This line is called the slow relaxation curve. Since the pressure has not reached equilibrium during a four minute run, the equilibrium pressure is obtained by a series of approximations such as to yield points giving the best straight line. If too high an equilibrium pressure is selected, the loci of resultant points after the short initial period curve down, while too low an equilibrium pressure gives a curve upward.

After obtaining the slow relaxation curve, for four or 30 minutes, the extrapolated portion is subtracted from the initial points to yield a straight line. This is called the fast relaxation curve. The corrected pressure curve is thus a summation of the fast relaxation curve, the slow relaxation curve and the equilibrium pressure. The three curves may be defined by obtaining their intercepts and slopes. Their slopes have been calculated as half-times which are the period of time during which the pressure drops to one-half of its value. The slope of the equilibrium pressure is zero. The intercepts of the three curves are obtained from the graph and K values are calculated from them on the basis of pressure rise/corrected ΔV. For example,

TABLE 2

SCLERAL DATA*

Sclera	Days PM	ΔV μl	P_t	K_t	K_{eq}	K_s	$L_s^{1/2}$ min.	K_f	$L_f^{1/2}$ min.
E_1	1	3	25.6	7.6	1.3	4.0	2.4	2.3	0.19
	1	3	25.1	7.2	2.4	3.2	1.6	1.6	0.10
	2	3	25.3	7.3	2.4	3.0	1.4	1.9	0.12
	3	3	25.9	7.8	2.6	3.2	1.4	2.0	0.09
E_1	8	4	27.1	5.7	2.0	2.1	1.7	1.6	0.10
	8	4	27.6	6.0	2.8	1.6	2.0	1.6	0.10
E_2	7	5	28.3	4.7	1.9	1.6	1.7	1.2	0.10
	8	4	26.3	5.3	3.1	1.3	1.8	0.9	0.13
G_2	5	2	20.4	6.9	2.5	3.1	1.2	1.3	0.09
	5	4	29.0	6.8	1.9	2.8	1.2	2.1	0.11
	5	6	39.1	7.5	2.2	3.6	1.1	1.7	0.10

* Between oil layers, calculated on a four-min basis. $P_0 = 12$ mm. Hg. Values corrected for chamber rigidity.

in the illustration cited, the equilibrium pressure was 14.5 mm. Hg, a rise of 2.5 mm. Hg from the initial base-line of 12 mm. Hg. The value 2.5 is then divided by the corrected ΔV of (6.0-1.45) μl. to give 0.5. This is called the equilibrium $K(K_{eq})$.

The intercepts of the slow and fast relaxation curves are 8.0 and 5.8 respectively. These yield a K_s of 1.8 and a K_f of 1.3. The total K is the sum of the three K values and is equal to $K_t = 3.6$.

If rubber membranes are used to surround the tissue the correction for the rigidity of rubber should be applied only to the K_{eq} as it does not affect the K_s, the K_f nor the slopes. From the data using rubber alone the rigidity was found to be 0.45. Assuming that the rubber was evenly and smoothly placed on either side of the sclera the full correlation of 0.45 should be subtracted from the K_{eq} and from the K_t. However it is possible that the rubber could be slightly buckled underneath the sclera and would then not contribute significantly to the scleral rigidity. From this reasoning the correction probably lies between 0.2 and 0.45.

No correction has been made for the amount of displacement of the return cycle from the base-line. It is difficult to tell how much of this total nonreturn is in the strain half cycle and how much in the removal-of-strain half cycle. As the amount of nonreturn

TABLE 3

SCLERAL DATA*

Sclera	Days PM	ΔV μl	P_t	K_t	K_{eq}	K_s	$L_s^{1/2}$ min.	K_f	$L_f^{1/2}$ min.
G_1	1	+3	18.9	2.9	0.4	1.4	12.7	1.1	0.36
		−3		2.6	1.3	0.4	4.0	0.9	0.22
	1	+6	28.3	3.6	0.5	1.8	9.1	1.3	0.35
		−6		2.3	1.5	0.3	4.2	0.5	0.30
	½	+7	28.2	2.9	0.5	1.3	7.6	1.1	0.36
		−7		1.7	1.2	0.2	5.5	0.3	0.40
	1	+9	39.2	4.1	0.6	2.0	8.9	1.5	0.43
		−9		2.3	1.6	0.3	4.9	0.4	0.27

* Between rubber membranes (each 0.003 in. thick). Calculated on a 30-min. basis. $P_0 = 12$ mm. Hg. Values corrected for chamber rigidity.

TABLE 4

AVERAGE DATA

	Four Min. Analysis				30 Min. Analysis (rubber)		
	Rubber		Oil		$+\Delta V$	$-\Delta V$	$\pm\Delta V$
	aver.	s.d.	aver.	s.d.	aver.	aver.	aver.
K_i	2.9	±0.7	6.6	±1.0	3.4	2.2	2.8
K_{eq}	1.5	±0.4	2.3	±0.5	0.5	1.4	0.95
K_a	0.9	±0.4	2.7	±0.9	1.6	0.3	0.95
$L_a^{1/2}$	1.7	±0.5	1.6	±0.4	9.6	4.7	7.2
K_f	0.5	±0.3	1.7	±0.4	1.3	0.5	0.90
$L_f^{1/2}$	0.09	±0.03	0.11	±0.03	0.38	0.30	0.34
No.	23		11		4	4	8

is small it was felt best not to correct for it until either a rational correction could be made or the nonreturn reduced to zero.

The data from this method of analysis are entered in Tables 1, 2 and 3. The data are separated to show the obvious difference arising from the techniques used. The averaged data are given in Table 4. The largest difference is in the use of oil or rubber. If the only effect of the oil were to do away with the elasticity of the rubber, then the oil K values should be smaller than the rubber K values (uncorrected for rubber) or equal to the corrected rubber K values. Evidently oil has affected the sclera in such a manner as to increase all of the K values without great change in the half-lives (table 4).

Another difference is the mathematical one of calculating on a four-minute or 30-minute basis. This results in higher half-lives (gentler slopes) for the 30-minute analysis. The explanation of this variance may be found either in the effect of the nonreturn or the possibility of another process taking place. The four-minute analysis emphasizes the rapidly changing events of the early part of the curve while the 30 minute analysis deals mostly with the slow die-away, small pressure differences and nonreturn. It will be noted from Table 4 that, if the pressure increments are averaged with the pressure decrements, the 30-minute K values correspond with the K values of the four-minute analyses, while the 30-minute values for the half-lives are much larger. The effect of this averaging would be to average out residual factors such as nonreturn and temperature differences. That the half-lives are significantly longer in the 30 minute analyses may be taken as an indication of other processes taking place.

It will be noted that the four-minute oil data differ from the four-minute rubber data chiefly in the K values while the 30 minute $\pm\Delta V$ data differ chiefly in the half-life values. It is of interest to see how these variations affect the curvature of the anelastic curves. In Figure 6 three curves

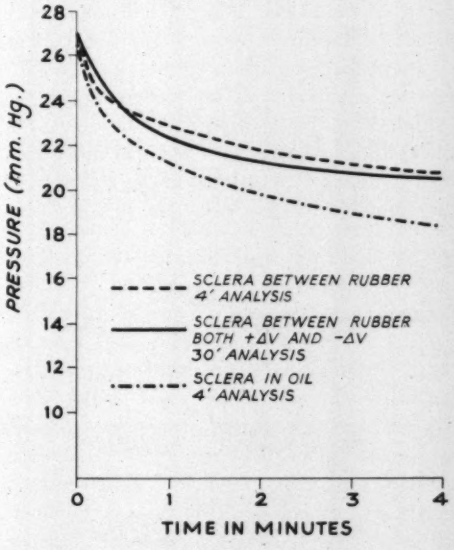

Fig. 6 (St. Helen and McEwen). Curves synthesized from average data.

have been synthesized from the data given in columns 1, 3 and 6 of Table 4 and plotted on linear paper. Increasing K values gives an over-all lowering of the curve, splaying out with time. The effect of longer half-lives is to produce a sharper initial drop followed by a more gradual decline.

Mechanical analogy

A clearer picture of the action of the sclera may be obtained by considering the mechanical analogy[4,5] shown in Figure 7. The system is composed of springs and dash pots arranged in series or in parallel with one another. A dash pot is a cylinder full of viscous fluid in which slides a piston. Figure 6 includes the whole chamber, with the scleral portion shown in heavy lines, and the solid chamber rigidity represented by the single spring in series with the sclera. The rubber rigidity is the small spring in parallel to the spring (Hookian body) of the sclera. The sclera is depicted as having three elements, a spring, and two Maxwell bodies (spring in series with a dash pot) in parallel with the Hookian body.

Let us first consider the action of the elements of the sclera. When the frame is displaced in the direction of the arrow there is an immediate extension of the springs (increased tension) and no movement of the cylinders of the dash pots. As time goes on the cylinder in each dash pot will move at a rate inversely proportional to the viscosity of the fluid in its dash pot, and directly proportional to the tension left on its series-connected spring. This movement relaxes the tensions of these two springs in an exponential manner.

After the Maxwell bodies have come to rest, the equilibrium tension will be only that in the Hookian body. We may relate these three rheologic bodies to the three elements found to explain the behavior of the sclera. The Hookian body is represented in the sclera by the equilibrium tension to which the sclera falls after a long period of time.

The equilibrium tension is measured as the equilibrium pressure and the spring constant is represented by K_{eq} which is $\frac{\Delta P}{\text{Corr. } \Delta V}$. The Maxwell bodies represent the slow and fast relaxation curves. The K_s and K_f are related to the springs in the Maxwell bodies and the $L^{1/}{}_s$ and $L^{1/}{}_f$ are functions of the viscosities of the fluids in the dash pots and of K_s and K_f.

The influence of the rubber is easily seen as adding to the Hookian body (equilibrium tension) and may be corrected by subtracting its rigidity alone from the rigidity of the sclera plus rubber. The influence of the rigidity of the chamber itself is a little more complicated. If the whole system is put under tension by moving the frame in the direction of the arrow, all springs will be extended and will be under increased tension. As the springs of the Maxwell bodies start to relax their tensions because of move-

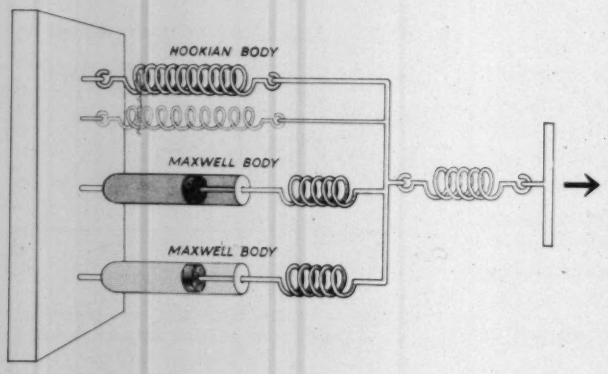

Fig. 7 (St. Helen and McEwen). Mechanical analogy of sclera and chamber. Unstippled springs are components of chamber and rubber rigidity.

ment of the cylinders in the dash pots, the chamber spring will have less pull on it and it will consequently contract which results in slight increase in tension of all three scleral elements plus rubber.

Removal of the applied strain by withdrawing fluid from the chamber has its analogous mechanical counterpart in returning the frame to its original position. This time the springs of the Maxwell bodies are in a state of compression and oppose the tension in the spring of the Hookian body. This results in a lower over-all tension in the system or analogously, a lower pressure in the chamber. Gradual relaxation of the Maxwell body springs leads to a greater tension in the Hookian spring and the over-all tension (pressure) rises. The effect of the chamber rigidity is to oppose the pressure rise just as it opposed the pressure fall during application of stress.

Discussion

The reason the sclera returns to a small value plus or minus to the base line has not been definitely determined. It is believed that slight frictional effects could explain this nonreturn. The frictional effect can be illustrated by the jerky motion of the finger as it is pushed along a table top. The rheologic mechanical analogy would be equivalent to inserting a mass resting on a surface between the spring and dash pot of a Maxwell body or by placing "gravel" in the dash pot. If this is the correct explanation it is probable that this frictional effect only shows up in static testing and is overcome in the living eye by the oscillating pulse pressure.

The effects which one might expect to find in such a study (the age of the eye, the time after enucleation, variations in thickness of scleral wall depending upon the particular area selected for testing) are all within the limits of error of the method. It appears that within the range of pressure increments studied the scleral rigidity shows no definite trend of variability with pressure. All other studies of ocular rigidity of enucleated eyes have shown that the ocular rigidity is not constant. This discrepancy has so many possible explanations—such as constancy over small pressure changes, large standard deviation, scleral versus ocular rigidity or lack of taking anelasticity into account in ocular rigidity studies—that the particular one must wait until more precise measurements over a greater range of pressures are made.

It is interesting to note that most of the "stiffness" of the sclera resides in the Maxwell bodies and the truly elastic component, the Hookian body, is relatively weak. This indicates that over long periods of time the sclera will stretch quite easily. It is only about one half as ultimately rigid as some natural rubbers of comparable thickness but this is not to be confused with ultimate elongation: the $\frac{\Delta L}{L}$ before rupture. Rubber has a large ultimate elongation while that for the sclera is unknown but is almost certainly small compared to rubber. It should be noted that a rise of 30 mm. Hg above normal would increase the diameter of the eye only about one part per thousand.

At first sight it might appear that the rheologic elements found in the sclera (Hookian and Maxwell bodies) could be identified with the action of microscopic or submicroscopic fibers or fibrils in the sclera. From the work on polymeric substances which exhibit a rheologic behavior similar to the sclera it appears that the identification of some of the rheologic elements of the sclera is on the molecular level and deals with such forces as hydrogen bonding and van der Waals' forces.

It is apparent that the action of the Maxwell bodies dissipates energy. They do not store energy as do the Hookian bodies. Because of this loss, the sclera shows a hysteresis effect[6] when cycled. This anelastic behavior is a property of the sclera and acts whenever there is a change in tension of the scleral walls. Hence, except for instantaneous measurements after sufficient periods of time

to insure equilibration, all measurements of scleral or ocular rigidity and tonography must contain this dependency on time of scleral tension. That this effect has not been more apparent in tonographic studies is not surprising in that the outflow itself, on rectilinear paper, is a curve and the anelastic effects merely change the curvature without providing gross discontinuities which would call attention to them. However, it is probable that the fast relaxation curve found in the sclera may find its counterpart in the fast initial drop encountered in some tonographic curves. Positive identification cannot be made until more precise data are collected and analysis is made both on sclera and on tonograms.

It is hoped that refinements in technique of measurement of the rheologic behavior of the tissues of the eye will produce data more in conformity with the conditions which exist during tonography (37°C. slight oscillatory pressure changes and relaxation of applied stress because of increased aqueous outflow). With a single equation relating the rheologic and hydrodynamic elements of the eye, it may be possible to define more precisely the reaction of the normal eye to changes in stress and to pinpoint the particular element at variance with the normal in pathologic states.

Summary

1. There is a relaxation of tension in the scleral wall of a human eye after application of a strain. This behavior is termed anelasticity.

2. The anelastic behavior has been analyzed into three components, two of which are time dependent and account for the relaxation of tension.

3. The possible effect of this time dependent factor on tonography has been indicated but particular application awaits more precise formulation.

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CHANGING TRENDS IN THE HOSPITAL MANAGEMENT OF RETINAL DETACHMENT*

William G. Everett, M.D., and M. R. Hoovler, C.R.L.
Pittsburgh, Pennsylvania

Purpose

The purpose of this paper is to present a comparative statistical analysis of medical record data reflecting the hospital course and medical management of retinal detachment patients in a typical eye, ear, nose and throat facility of an average medical school-affiliated hospital between the years 1945 to 1949 and 1955 to 1959.

Introduction

Although the clinical entity of retinal detachment was described as early as 1722 by

* From the Department of Ophthalmology, University of Pittsburgh, School of Medicine, and the Eye and Ear Hospital of Pittsburgh. This study was supported in full by U.S. Public Health Grant No. B-2481.

St. Yves,[1] a rational treatment for retinal detachment was not known until 1930 when Gonin[2] clearly defined the etiologic factor of a retinal tear in retinal detachment. Since this report, rapid advances have occurred in the management of retinal detachment, challenging even the most studious ophthalmic surgeon to keep well informed.

Perhaps the most dramatic advances in this field have occurred since the introduction of the lamellar-scleral-shortening operation for retinal detachment in 1951 by Shapland,[3] Paufique[4] and Dellaporta.[5] Innumerable modifications for shortening of the sclera have been advanced to the present time. In 1951 Custodis presented, before the German Ophthalmological Society in Heidelberg,[6] his findings on the use of plastic inserts in the sclera. The scleral buckling procedure of Schepens[7] utilizing an encircling polyethylene tube has received wide attention in this country. The development of the photocoagulator by Meyer-Schwickerath[8] promises to be another significant advance in the treatment of retinal detachment.

The results of these improvements in the treatment of retinal detachment are evidenced not only by an increasing percentage of surgical successes but also by a reduction in duration and degree of disability to the patient.

We believe that the period of 1945 to 1949, as compared to 1955 to 1959 when scleral shortening surgery had become well accepted, would most graphically demonstrate the changing trends in the hospital management of retinal detachment.

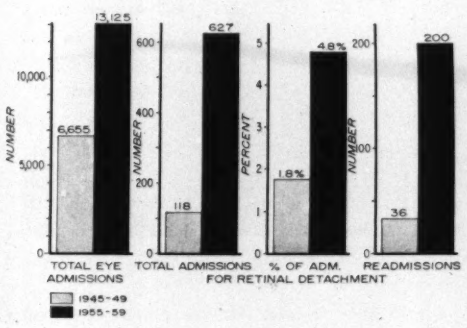

Fig. 1 (Everett and Hoovler). Total hospital admissions and admissions for retinal detachment between the periods 1945 to 1949 and 1955 to 1959.

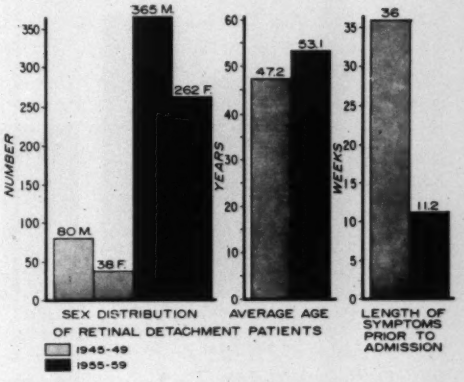

Fig. 2 (Everett and Hoovler). Sex distribution, average age and duration of symptoms in groups studied.

Materials and Methods

All of the admissions to Eye and Ear Hospital of Pittsburgh, Pennsylvania, on the Ophthalmology service, between the periods of 1945 to 1949 and 1955 to 1959 were included in this study. The information available from the hospital records during these two periods, of all cases with a primary diagnosis of retinal detachment, was analyzed.

Results

There was a total of 6,655 eye admissions in the first group (1945 to 1949) compared to 13,125 eye admissions in the second group (1955 to 1959) as shown in Figure 1. Of these admissions 118 cases were admitted for retinal detachment in the earlier group compared to 627 cases in the second group. This represents an increase from 1.8 percent of all eye admissions in the first group to 4.8 percent in the second group. The readmission number in the two groups was not significantly different, being 30.5 percent in the first group and 32 percent in the second.

Figure 2 shows the sex distribution, the average age, and the duration of ocular

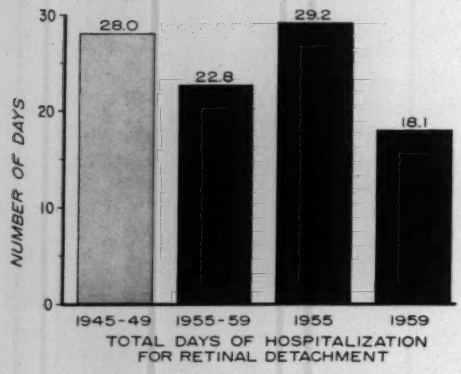

Fig. 3 (Everett and Hoovler). Total operations performed and percent not operated in both groups.

symptoms of retinal detachment at time of admission. In the first group, only 32 percent of retinal detachment admissions were females compared to 41 percent females in the second group. The duration of symptoms in the second group was only one third as long as that found in the first group.

The duration of hospitalization in the two groups was 5.2 hospital days less in the second group as shown in Figure 3. It is interesting to note the comparison of the individual years of 1955 against 1959 (fig. 3). The hospital stay was longer in 1955 than the average for the first period (1945 to 1949). There was a decrease of 11.1 days in the four years from 1955 to 1959, indicating a major reduction in hospital stay has occurred in the very recent years.

The number of operations performed for retinal detachment increased six times in the second period (fig. 4) compared to the first period. It seems important that only 5.5 percent of retinal detachment patients were unoperated in the second group against 26.3 percent unoperated in the earlier group. These figures do not include patients with tumor, but only those cases admitted and considered inoperable, transferred because of medical complications, or patients who signed their own release. One of the most revealing trends of this study is the type of operations performed (fig. 5). In the first group, 92 percent of the surgical procedures were retinopexy operations and eight percent were scleral shortenings. In the second group of patients only 51 percent of operations were retinopexies and 49 percent were scleral shortening operations. Even more striking is a comparison between the year 1955 and the year 1959: 31 percent of the operations performed in 1955 were of the scleral shortening type in contrast to 62 percent in 1959.

Discussion

According to the most recent greater Pittsburgh area statistics, Allegheny County has a population of 1,622,837, of which 3,345

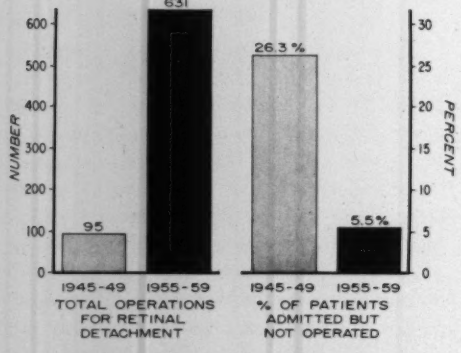

Fig. 4 (Everett and Hoovler). Duration of hospitalization in two groups studied and in individual years, 1955 to 1959.

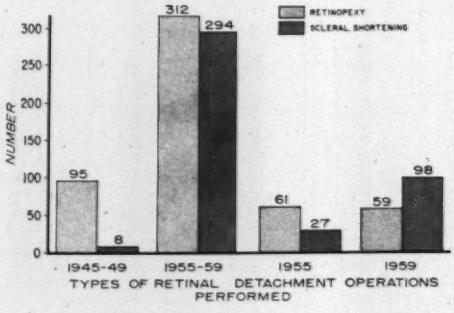

Fig. 5 (Everett and Hoovler). Type of surgery performed in two groups and in separate years, 1955 and 1959.

persons are known to be blind. This is two percent of the total population and corresponds to the over-all figure for the nation. In 1934, the state of Pennsylvania inaugurated its *Assistance for the Blind* program, and the first statistical compilation of the causes for blindness in Pennsylvania became available in 1936.[9] In 1959, there were 1,635 persons in Allegheny County receiving assistance for the blind. Of these persons, 126 or 7.8 percent suffered from retinal detachment. In 1937, among 1,115 persons in this area receiving blind assistance, only 17 (1.5 percent) reported having retinal detachment. Although the increase in persons receiving blind assistance has been slight, the increase in percentage of cases of blindness due to retinal detachment is significant. It is possible that retinal detachment cases were included in the general grouping of retinal diseases in the earlier report. Currently, case identification and classification is probably more accurate and may reflect an increased awareness of and interest in improved handling of retinal detachments.

The total number of admissions to the eye service of the Eye and Ear Hospital was approximately doubled during the periods studied; however, the admissions for retinal detachment increased six times. Increased life expectancy might be considered the cause of a greater prevalence of retinal detachment in the groups more recently studied; yet, the fact that life expectancy for both sexes increased from 67.5 years in 1947 only to 69.3 years in 1957 is an argument against this conclusion. We believe the increased number of hospital admissions for retinal detachment reflects more accurate diagnosis and increased confidence in the surgical treatment of retinal detachment. The smaller percentage of cases admitted but not operated in the later group seems to favor this opinion. The importance of the frequency of bilaterality of detachment, as reported by Dunnington and Manie,[10] has been stressed widely in recent years. This probably has decreased the tendency to forget about the detached eye and rely on the remaining "good" eye. The reduction of duration of symptoms by a third, from 36 weeks to 11 weeks, indicates improved awareness of eye care, by both the patient and physician.

Shipman[11] analyzed 400 retinal detachment cases from his practice in 1950, and reported an average hospital stay was 32 days. His cases were collected between 1933 and 1949. This figure is similar to that of our first group. The reduction of length of hospitalization in the two groups by 5.2 days is not remarkable; however, the change from 29.2 days in 1955 to 18.1 days in 1959, a decrease of 11.1 days, is most impressive. The similar change from a preponderance of simple retinopexy operations in 1955 to almost twice as many scleral shortening operations as retinopexy procedures in 1959 may be related to this decrease in duration of hospitalization. We are impressed that the advocates of scleral shortening operations for retinal detachment usually recommend earlier ambulation and shorter convalescence. Our figures indicate a trend toward increased numbers of scleral shortening operations and shorter duration of hospitalization.

The medical records reviewed in this study included cases from private and clinic services, consequently, only the hospital course could be studied as posthospitalization follow-up was not possible. For this reason, no mention is made of the success or failure in the treatment of retinal detachment; however, it is interesting to speculate the possible success on a 50-percent cure rate in both groups of this study. This percentage figure undoubtedly favors the earlier group, as a 50-percent cure rate was more realistic in this group, but in the late 1950's, the time of the second group, a 50-percent cure rate would be considered poor by most detachment surgeons. Of the first group of 118 patients, 26 percent were not operated; therefore a 50-percent cure rate of the 95 operated cases yields 47 possible cures. Cal-

culating the second group in the same way, results in 298 possible cures! A conservative estimate, therefore, shows 251 more eyes salvaged in the second group. This is a speculative figure only but it seems an encouraging one considering the over-all problem of retinal detachment and blindness.

Conclusions

We conclude from this study that more patients are receiving hospital care for retinal detachment in recent years. This increase probably represents earlier and more accurate diagnosis with more definitive treatment of cases with retinal detachment. The length of hospitalization of patients with retinal detachment has been significantly reduced in recent years. The more frequent use of scleral shortening operations for retinal detachment may be a factor in reducing the duration of hospitalization. Speculative analysis of the information obtained in this study suggests that the vision of many more patients is currently being restored.

Summary

An analysis of the medical records of patients admitted with a primary diagnosis of retinal detachment to the Eye and Ear Hospital of Pittsburgh, between the years 1945 to 1949 and 1955 to 1959, is presented.

The changing trends in the hospital management and surgical approach of retinal detachment as demonstrated by the records of the two groups are graphically shown and discussed.

We conclude that the number of cases identified, treated, and the vision restored is significantly greater in recent years.

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CLINICAL EXPERIENCES WITH DEMECARIUM BROMIDE (BC-48) IN THE TREATMENT OF GLAUCOMA*

IRWIN S. TERNER,† M.D., JAY G. LINN, JR., M.D., AND ROBERT GOLDSTROHM, M.D.
Pittsburgh, Pennsylvania

Demecarium bromide (BC-48 or Humorsol) is a potent, water-soluble, synthetic miotic which acts by the inhibition of cholinesterase.

This agent is a quartenary ammonium compound (four methyl groups attached to a nitrogen molecule) and is composed of two neostigmine molecules carrying two permanent positive charges which are separated by a moderately long carbon chain (fig. 1). This results in a significant enhancement of the potency and duration of action in comparison with the monomeric compound neostigmine. The chemical name of demecarium bromide is decamethylene-bis (m-dimethylaminophenyl-N-methyl-carbamate) dimethobromide. Stedman[1] and his co-workers demonstrated in 1926 that the activity of the physostigmine group of drugs is due largely to the presence of the methyl carbamic ester group (CH_3NHCOO) and that other related compounds showing cholinesterase inhibitory action are basically substituted phenyl esters of alkylcarbamic acids.

Demecarium bromide has the empirical formula $C_{32}H_{52}O_4Br_2$. In neutral solution it appears to be stable for indefinite periods. However, heating in alkaline solution rapidly decomposes the carbamate ester groups.

Numerous studies of this new drug have been reported in the foreign literature and more recently in the American literature.

Kraupp[2] demonstrated that demecarium bromide inactivates both true cholinesterase (found in erythrocytes) and pseudocholinesterase (found in plasma), the former being somewhat more susceptible. The alkyl phosphates such as isofluorophate (DFP) and tetraethylpyrophosphate (TEPP) on the other hand chiefly inhibit pseudocholinesterase. Eserine and neostigmine have equally strong inhibition of both true and pseudocholinesterase. Certain experiments reported by Kraupp and his co-workers suggest that the complex formed by the union of demecarium bromide and cholinesterase is more stable than that formed with neostigmine. For example, the addition of acetylcholine to a mixture of cholinesterase and demecarium bromide failed to restore the activity of the cholinesterase, as occurred when this procedure was carried out using neostigmine as the inhibitor. Such results indicate that acetylcholine does not displace demecarium bromide to the same extent as it does neostigmine from the inhibitor-enzyme complex. The more stable complex probably accounts for the substantially longer duration of action observed with demecarium bromide in contrast with neostigmine. On the other hand, a stable complex between demecarium bromide and cholinesterase does not imply that the enzyme is inhibited irreversibly or destroyed, as is considered to be the case with isofluorophate (DFP).

In pharmacologic studies it has been demonstrated that atropine and 2 pyridine aldoxime methiodide (2-PAM) antagonize the lethal effects of demecarium bromide in mice.[3]

Gittler and Pillat[4] reported a study on a series of 67 eyes in 53 patients treated with one-percent demecarium bromide and observed for a two-week period. A satisfactory decrease in intraocular pressure was accomplished in 50 percent of their chronic

* From the Glaucoma Clinic, Department of Ophthalmology, University of Pittsburgh, School of Medicine. The research relating to this study was financed by Merck Sharp & Dohme and The Ophthalmic Foundation of Pittsburgh. The demecarium bromide (BC-48 or Humorsol) used in this study was furnished by Dr. Edmund DeMaar of Merck Sharp & Dohme. Presented in part at the 11th annual Clinical Conference of the Wills Eye Hospital, February 20, 1959, Philadelphia, Pennsylvania.

† Address: 1200 Chartiers Avenue, McKees Rocks, Pennsylvania.

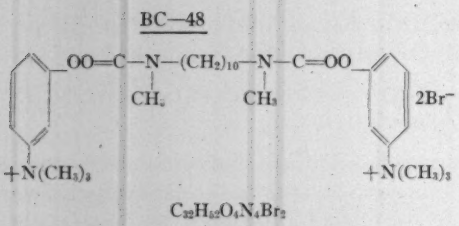

Fig. 1 (Terner, Linn and Goldstrohm). Structural formula of demecarium bromide.

noninflammatory glaucoma cases (19 eyes). One-half of these cases were previously treated unsuccessfully with pilocarpine and eserine. In 10 eyes with acute glaucoma, three showed a rapid decrease of intraocular pressure. Those eyes in this group previously treated with eserine did not respond to demecarium bromide and the authors felt that pretreatment with eserine blocked the action of demecarium bromide similar to the blocking effect of eserine on isofluorophate. Other better results occurred in six eyes with secondary glaucoma in aphakia.

Gougnard[5] found that the concentrations of 0.2 and 0.3 percent were the best tolerated demecarium bromide solutions in comparison to the one-percent solution used by Gittler and Pillat and the 0.5-percent solution employed by Miller, Divert and Crouzet.[6] He summarized his indications for the use of demecarium bromide stating that they are the same as those for isofluorophate, namely, open-angle glaucoma insufficiently normalized by pilocarpine or that which presents a moderate hypertension after iridencleisis, and aphakic glaucoma where demecarium bromide and isofluorophate must be used with prudence and in moderate dosage. He is of the opinion that demecarium bromide must be suspended before surgical intervention into the anterior chamber because it seems locally to antagonize pigment migration which predisposes to posterior synechias.

Miller, Divert and Crouzet[6] used one drop of demecarium bromide (0.5-percent) in 26 glaucomatous eyes. In all 11 cases of chronic simple glaucoma the decrease in ocular tension was rapid, usually starting within two hours after instillation of demecarium bromide and lasting from three to 60 days. The local tolerance of the drug was found to be good. No allergic reactions were manifest.

Drance[7] reported a marked decrease in ocular tension in five normal eyes 12 hours after the instillation of one drop of 0.5-percent demecarium bromide which persisted for three to five days. This was accompanied by increased facility of outflow in each case. In 38 of 40 eyes with chronic simple glaucoma there was a significant decrease in ocular tension after instillation of 0.25 or 0.1-percent demecarium bromide. The two eyes which failed to respond were eyes with absolute glaucoma. Thirty of 34 eyes with chronic simple glaucoma showed a considerable increase in the facility of outflow on tonographic study. Three out of four eyes which failed to show any increase in facility of outflow showed a significant fall in the intraocular pressure. The hypotensive action of demecarium bromide was accompanied in the great majority of normal and glaucomatous eyes by intense miosis, some spasm of accommodation, dilatation of the conjunctival vessels, ocular discomfort, and headache in the brow overlying the treated eye. The unpleasant side-effects tended to wear off with continuous use of the drops.

Becker and Gage[8] studied the effects of demecarium bromide in 144 eyes of 76 patients. They used the 0.25-percent concentration once or twice daily and if this failed the 1.0-percent concentration was used once daily. Where necessary, secretory inhibitors were continued in addition to the altered miotic regimen. They included only those patients that were treated for longer than six months and rigid criteria for control were established. They concluded that an intraocular pressure of less than 20 mm. Hg could be obtained in over one half of the previously uncontrolled glaucomatous eyes and in approximately 30 percent of such eyes this

status of control could be maintained for periods of over six months. These results were similar to those found in another group of glaucomatous eyes started on ecothiophate iodide (Phospholine Iodide®).

Krishna and Leopold[9, 10] studied the effects of demecarium bromide on normal rabbit eyes and normal and glaucomatous human eyes. They observed no blocking effect of physostigmine for demecarium bromide as occurs with physostigmine and isofluorophate and physostigmine and ecothiophate iodide. Clinically, they employed concentrations of 0.1, 0.25, and 0.5-percent which were used twice daily in some and as little as twice weekly in others. Of the 106 glaucomatous eyes in their series, 57 eyes were uncontrolled on previous therapy while only 19 eyes were uncontrolled after treatment with demecarium bromide. They did not use aqueous inhibitors concomitantly except in two eyes which required the use of acetazolamide.

Use of demecarium bromide in the treatment of glaucoma

Forty-seven patients with 90 glaucomatous eyes were treated with demecarium bromide in periods ranging from six weeks to 18 months at the Glaucoma Clinic of the University of Pittsburgh School of Medicine from August, 1958, to March, 1959. The patients selected for this study had been previously treated for glaucoma or were recently discovered proven cases. In most instances the group included patients who had been under observation and treatment with miotics for many months, and in some cases for years. Many of the patients had tonographic studies performed while under treatment with a miotic prior to treatment with demecarium bromide. All other ocular medication was eliminated with the introduction of demecarium bromide except for 10 of these patients. In most cases, if drugs other than demecarium were necessary to control the tension, the patients were not included in the study. It was felt that true glaucoma control by a specific miotic could not be properly evaluated if other miotics, sympathomimetics or carbonic anhydrase inhibitors were employed simultaneously.

Dosage

The dosage of demecarium bromide varied in each individual case. Three concentrations of the drug were employed; 0.5 percent, 0.25, and 0.1 percent. Initially most patients were placed on the 0.5-percent concentration. However, it was found that the side-effects such as browache, blurred vision due to ciliary spasm, and occasional nausea were very frequently intolerable. By reducing the concentration of the drug to 0.25 percent, and in some cases to 0.1 percent and increasing the frequency of instillation, the side-effects became minimal and the therapeutic effects adequate. Instillation varied from thrice daily to once every third day.

Criteria for control

The main basis for control was an ocular tension of a scale reading of three with a 5.5 gm. weight (24.4 mm. Hg Schiøtz) or less with a standard mechanical Schiøtz tonometer which persisted during the entire period of observation. This was compared to the previous ocular tension during the past three to six months. Visual field loss and outflow studies also aided this determination as well as other routine glaucoma findings.

Results of present study

The results are summarized in Table 1. The group is subdivided into seven categories and each category is discussed individually.

I. Open-angle glaucoma

A total of 54 eyes with open-angle glaucoma were treated with demecarium bromide. Of these, 39 eyes were free of peripheral anterior synechias while 15 eyes were found to have some peripheral anterior synechias.

Of the 39 eyes free of peripheral anterior synechias six were controlled on pre-

TABLE 1

SUMMARY OF RESULTS

Types of Glaucoma	Total No. Eyes	Controlled on Previous Rx	Uncontrolled on Previous Rx	No Previous Rx	Controlled on BC-48	Uncontrolled on BC-48
1. Open-angle						
A. No peripheral anterior synechias	39	6 (15.3%)	31 (79.4%)	2 (5%)	19 (48.7%)	20 (51.3%)
B. With peripheral anterior synechias	15	3 (20%)	12 (80%)	0	9 (60%)	6 (40%)
2. Angle-block	6	2 (33.3%)	4 (66.6%)	0	3 (50%)	3 (50%)
3. Glaucoma with aphakia	10	0	8 (80%)	2 (20%)	4 (40%)	6 (60%)
4. Aphakic glaucoma						
A. Angle-block	8	5 (62.5%)	3 (37.5%)	0	8 (100%)	0
B. Pupil-block	2	0	2 (100%)	0	0	2 (100%)
C. Combination A & B	5	2 (40%)	1(20%)	2 (40%)	4 (80%)	1 (20%)
5. Absolute glaucoma	1	0	1 (100%)	0	0	1 (100%)
6. Secondary glaucoma						
A. Granulomatous uveitis	1	0	1 (100%)	0	0	1 (100%)
B. Congenital lens luxation	1	0	0	1 (100%)	0	1 (100%)
C. Uveitis following aphakia	2	1 (50%)	1 (50%)	0	1 (50%)	1 (50%)
TOTAL	90	19 (21%)	64 (71%)	7 (8.0%)	48 (53.0%)	42 (47.0%)

vious medication while 31 eyes were previously uncontrolled. Nineteen of the 39 eyes were controlled with demecarium bromide. Two of these eyes were started on demecarium bromide as initial glaucoma medication and were adequately controlled with the drug. Eight eyes were subsequently controlled with the addition of epinephrine bitartrate (two percent or naphazoline HCl (0.1 percent) (Privine HCl®). All of the eyes previously controlled with other medication were subsequently controlled with demecarium bromide and in most instances with less frequent instillation of medication.

In one case demecarium bromide alone reduced the ocular tension to a normal range, whereas pilocarpine (two percent), eserine (0.25-percent ointment at night) and Diamox (250 mg. three times a day) were previously needed to obtain the same level of reduction. Five eyes had normalized tensions only after the use of demecarium bromide combined with Diamox. One eye uncontrolled on demecarium bromide was normalized following a Stallard iridencleisis and needed no further medication. In 18 of the 39 eyes in this group, comparison was made of tonograms taken on previous medication and those after treatment with demecarium bromide. Fourteen of these eyes showed an increased facility of outflow while four revealed no change.

Of the 15 eyes found to have an open-angle mechanism with peripheral anterior synechias, three were controlled on previous medication, while 12 eyes were uncontrolled. Nine of these eyes were subsequently controlled on demecarium bromide and six remained uncontrolled. All of the eyes previously controlled on other medication were subsequently controlled on demecarium bromide.

One case developed a dermatitis of the eyelids which was thought to be due to demecarium bromide. Dermatologic examination later revealed a neurodermatitis of the anus, neck, and eyelids not due to ocular medication. Two eyes of this group were controlled with the addition of epinephrine bitartrate or naphazoline twice daily. In 12 of the eyes in this group tonograms revealed an increased facility of outflow in nine, while three eyes showed no change.

It is interesting to note that there is little difference statistically between these two groups of open-angle glaucoma although the group with peripheral anterior synechias is the more advanced of the two and usually more difficult to control clinically.

II. Angle-block glaucoma

A total of six eyes in three patients with angle-block glaucoma were treated with demecarium bromide. One case was that of a 54-year-old Negress in whom bilateral iridencleisis was performed for angle block. The surgery did not alleviate the glaucoma and she subsequently was controlled on Carbachol. After treatment for five months with demecarium bromide her tension control improved. Tomography revealed an increased outflow facility in the left eye while there was no change in outflow facility in the right eye after treatment.

Another case was that of a 67-year-old white woman with angle-block mechanism in each eye combined with lens intumescence. Pilocarpine (three percent) controlled the right eye but failed to control the left eye. Outflow studies revealed decreased facility in the left eye which was alleviated by lens extraction. We believe that by increasing miosis in cases such as this one, an acute attack of glaucoma may be precipitated due to the decrease in escape of aqueous through the miotic pupil and the possibility of pupil block and an iris bombé effect.

The third case was that of a 41-year-old white woman whose tension was uncontrolled with pilocarpine (three percent) and naphazoline (0.1 percent), substituting demecarium bromide (0.25 percent) for pilocarpine (3.0 percent) and continuing the naphazoline (0.1 percent) controlled the tension in both eyes. Tonograms were not available for comparison in this case.

III. Glaucoma with aphakia

In 10 eyes of six patients, in which aphakia was pre-existing and not causative, glaucoma was present. All but one eye had sector (complete) iridectomies at the time of cataract surgery. Of these, eight were uncontrolled on previous medication while two had no previous medication. After treatment with demecarium bromide, four eyes met our criteria for control. In one case after instillation of demecarium bromide the patient complained of severe browache 45 minutes later. This was relieved by instilling pilocarpine (one percent) first, followed by demecarium bromide (0.25 percent) in 30 minutes. After three weeks of pre-instillation of pilocarpine, the patient could tolerate 0.25-percent demecarium bromide alone.

IV. Aphakic glaucoma

This category is divided into three etiologic types. There were eight eyes of the angle-block type of which five were controlled on previous medication. All of these eyes were subsequently controlled with demecarium bromide. There were two eyes of the pupil-block type and these were neither controlled prior to nor after the use of demecarium bromide, as would be expected. However, the addition of naphazoline HCl (0.1 percent twice daily) controlled these eyes. Of the five eyes with a combination of both angle- and pupil-block glaucoma, two of these were controlled on previous medication, two had no previous medication and one was uncontrolled on previous medication. Four of these eyes were controlled with demecarium bromide. The eye which was previously uncontrolled was not controlled with demecarium bromide although there was an increase of facility of outflow in this eye compared to the tonograms made while isofluorophate was being administered. In one other case the outflow facility with demecarium (0.1 percent every three days) was increased over that with isofluorophate (0.1 percent every three days).

V. Absolute glaucoma

Demecarium bromide was used in one eye with absolute glaucoma. The tension ranged between 50 and 75 mm. Hg on previous medication. With demecarium bromide the

TABLE 2

DURATION OF TREATMENT AND CONTROL WITH BC-48
(Includes 19 eyes previously controlled and seven eyes with no previous therapy)

Time (Mo.)	Total No. of Eyes	Controlled 24 mm. Hg or Less	Controlled 20 mm. Hg or Less
0–6	40	14	9
7–12	18	12	3
13–18	32	22	1
TOTAL	90	48 (53%)	13 (14%)

tension remained in the 50s most of the time. This patient experienced no intolerable discomfort either before or after the use of demecarium bromide. There was slight burning after instillation of all miotics used in this case.

VI. SECONDARY GLAUCOMA

One eye with glaucoma following granulomatous uveitis was uncontrolled with Carbachol and naphazoline HCl and remained uncontrolled with demecarium bromide. However, the addition of Diamox controlled this eye. Another eye with congenital lens luxation failed to meet our criteria for control although the tension has been reduced considerably since the initial discovery of tension elevation. A third case of secondary glaucoma, that of uveitis following aphakia in a 60-year-old Negro was rather interesting. The left eye was controlled previously with isofluorophate and remained controlled with demecarium bromide. The right eye was uncontrolled with isofluorophate and the tension ranged from 40 to 87 mm. Hg (Schiøtz). One month after the use of demecarium bromide the vision decreased from 20/100 to light perception. Following this visual change, hypotony was noted. Ophthalmoscopy was not possible, but a retinal detachment was suspected.

COMMENTS

Forty-eight eyes or 53 percent of the eyes in this series were controlled on demecarium bromide, while 19 of these eyes or 21 percent were controlled on previous medication (table 2). If the previously controlled eyes (19) and those which were started initially on demecarium bromide without previous medication (seven) are eliminated, it is seen that approximately 34 percent of the previously uncontrolled eyes were controlled with demecarium bromide alone (table 3). If only the eyes of those patients who have been on the drug longer than six months are considered (31 eyes), 50 percent (15 eyes) were controlled at 24 mm. Hg or less while only one eye (three percent) was controlled at 20 mm. Hg or less. These figures agree favorably with those of Becker and Gage,[8] who found that approximately one third of the eyes that could not be controlled on the usual miotics and secretory suppressants were controlled with the addition of demecarium bromide. They also found that 25 percent of all eyes with previous poor control (above 24 mm. Hg) could be successfully controlled for periods of over six months. In our series only one eye could be maintained below 20 mm. Hg for longer than six months while 15 eyes (50 percent) could be maintained at 24 mm. Hg or less for a period longer than six months. This discrepancy is most likely due to the fact that, in this series, control was maintained with demecarium bromide alone and in the series of Becker and Gage topical epinephrine bitartrate and/or systemic carbonic anhydrase inhibitors were also utilized for control and only the miotics were changed.

In order to evaluate the effect of demecarium bromide on the facility of aqueous

TABLE 3

DURATION OF TREATMENT AND CONTROL WITH BC-48
(Includes only previously uncontrolled eyes)

Time (Mo.)	Total No. of Eyes	Controlled 24 mm. Hg or Less	Controlled 20 mm. Hg or Less
0–6	33	7	4
7–12	9	5	1
13–18	22	10	—
TOTAL	64	22 (34%)	5 (8%)

TABLE 4

COMPARISON OF AQUEOUS OUTFLOW FACILITY

Types of Glaucoma	No. of Eyes	Increased Facility	Decreased Facility	No Change
1. Open-angle				
A. No peripheral anterior synechias	18	14	0	4
B. With peripheral anterior synechias	12	9	0	3
2. Angle-block	4	1	1	2
3. Glaucoma with aphakia	2	2	0	0
4. Aphakic glaucoma				
A. Angle-block	3	3	0	0
B. Pupil-block	0	0	0	0
C. Combination A & B	2	2	0	0
TOTAL	41	31	1	9

outflow, tonographic studies were performed. Forty-one eyes of this series had tonograms performed while on previous medication and following treatment with demecarium bromide. Table 4 summarizes the results of this comparison. In 31 eyes or 76 percent of those compared there was an increase in facility of outflow, while in one eye of those compared there was a decrease in facility of outflow. This eye had a closed-angle mechanism with an intumescent lens. Nine eyes showed no change in outflow facility after treatment with demecarium bromide. The group showing the greatest number of eyes with increased facility of outflow is, as expected, that with open-angle glaucoma.

SIDE-EFFECTS

The most common side-effect noted was a burning sensation with conjunctival injection after instillation of the drug. The degree was in direct proportion to the concentration used and the frequency of instillation. Most patients developed a tolerance to this discomfort after the first week of therapy. Browache and blurred vision due to ciliary spasm were the most disabling side-effects and the most persistent. Phakic eyes developed a false myopia which usually lessened somewhat after the third to fifth week of therapy. Two aphakic patients preferred the side-effects of demecarium bromide (0.25 percent) to Carbachol (1.5 percent). Two patients discontinued the 0.5-percent concentration of demecarium after only two days of medication due to severe browache and refused to continue with the drug. In another case the drug was discontinued due to a severe conjunctival irritation and inflammation which subsided when the drug was stopped. Conjunctival smears were negative for eosinophils. In one other case the drug was discontinued due to an allergic reaction with severe edema of the eyelids and face. This patient was also allergic to eserine and tetracaine. Nausea occurred in two cases.

There were no cases of fibrinous iritis. There were no iris cysts. However, we have had no experience with demecarium bromide in children and it is in this latter group that iris cysts are more likely to occur.

From the foregoing comment, it appears that treatment with demecarium bromide alone should control glaucoma in at least a third and possibly one half of those cases in which the commonly used miotics such as pilocarpine, Carcholin, eserine, or isofluorophate have failed. The drug should be tried prior to the use of secretory inhibitors or, if this fails, in combination with them.

SUMMARY

Demecarium bromide is a potent antiglaucomatous agent that appears to form a rever-

sible union with cholinesterase. It lowers intraocular pressure by increasing the facility of aqueous outflow. It requires less frequent administration than the other commonly used miotics and its advantage compared to isofluorophate is that it is stable and water soluble.

A total of 47 patients with 90 glaucomatous eyes have been treated with demecarium bromide in periods ranging from six weeks to 18 months. Forty-eight eyes or 53 percent were controlled on demecarium bromide. Of the previously uncontrolled eyes (64) 22 or one third were controlled with demecarium bromide alone. In the 31 eyes treated for over six months, 15 or 50 percent were controlled at 24 mm. Hg or less. Only one eye of this group was controlled at 20 mm. Hg or less.

A comparison of the facility of outflow was made in 41 eyes while on previous medication and after therapy with demecarium bromide. Seventy-six percent had an increase in outflow facility while only one eye developed a decrease in outflow facility. The majority of eyes with increased facility of outflow after the use of demecarium bromide were eyes with open-angle glaucoma.

Side-effects occurred in direct proportion to the concentration of the drug used and frequency of instillation. In the 0.5-percent strength browache and blurred vision were intolerable in many instances. However, by reducing the concentration to 0.25 percent and in some cases to 0.1 percent and increasing the frequency of instillation to twice or three times a day, the side-effects became minimal and the therapeutic effects were adequate.

In several cases the side-effects of demecarium bromide were better tolerated than those associated with isofluorophate or Carcholin.

Demecarium bromide had its greatest therapeutic effect in open-angle glaucoma and in aphakic glaucoma. Treatment with demecarium bromide should control at least one third and possibly one half of those cases in which the commonly used miotics have failed. It should be tried prior to the use of secretory inhibitors or, if this fails, in combination with them. The drug is probably contraindicated in angle-block glaucoma of phakic eyes.

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INCLUSION OF ABSORBABLE GELATIN FILM BETWEEN THE SCLERAL LAMELLAE*

In the treatment of retinal detachment

Antonio Borrás, M.D.
Montevideo, Uruguay

After the demonstration by Gonin of the pathogenesis of retinal detachment, the early efforts for therapy were all directed primarily toward the sealing or closure of the retinal tear through an adhesive chorioretinitis, produced either through some chemical, thermal, or electrocoagulative process. To effect such a closure, it was necessary that the choroid and retina be and remain in contact until the adhesions had become permanent.

In some cases, however—notably those in which the detachment was caused by traction bands in the vitreous or was complicated by organized retinal folds—it was often impossible either to effect or to maintain such contact. To meet these difficulties, various additions were made to the accepted steps of diathermy coagulation and drainage of the subretinal fluid. To effect contact various scleral shortening operations, such as scleral resection or buckling, were introduced. To maintain contact through the time required for the adhesions to become organized and also to effect contact in some cases, other procedures were employed. Chief of these were the use of encircling sutures, either a plastic tube embedded in a scleral trough, or the nylon thread "cerclage" suture recommended by Arruga. These latter operations appeared to have certain drawbacks: (1) the area under treatment was narrow and the tear might be left outside the operated zone: (2) plastic material inside the eye might produce adverse reactions such as scleral necrosis; (3) after operation the eye remained deformed.

Absorbable gelatin film has been used extensively in general surgery, especially for the control of hemorrhage. It has been used in glaucoma surgery by Barski and Schimek, by Laval and by Lehman and McCaslin. It has been employed in retinal detachment surgery as an implant by Pierce, who placed the gelatin film between the conjunctiva and the operated area of the sclera to avoid adhesions, and by Strampelli, who included it between the sclera and the choroid in three cases, in 1954, although he gave no particulars on the final condition of the patients.

From the data reported by these authors, it is possible to draw certain conclusions. These are (1) the gelatin film produces a moderate reaction when placed between the sclera and the choroid; (2) the films are absorbed in from three to 16 weeks; (3) when placed externally, the films cause only a very slight inflammatory reaction.

With this data in mind, it seemed to me that the use of gelatin film was well justified in an attempt to bring the choroid into contact with the retina, and to hold it in such position for the necessary length of time. The advantages of this procedure would be (1) the included material would be completely absorbed and finally no foreign substance would remain in the eye; (2) the included area could be made sufficiently large to cover the tear with certainty; (3) the quantity of gelatin film could be regulated at will in order to obtain the degree of choroidal indentation deemed necessary; (4) the gelatin film is nonantigenic and there would be no danger of any allergic reaction.

The following disadvantages could also be envisaged, however: (1) the degree of inflammatory reaction might be excessive; (2) in some cases it might be impossible to

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* From the Departmnet of Ophthalmology, University of Montevideo. Since this paper was prepared for publication, several reports on the same subject have appeared to which reference has not been made (author).

achieve the necessary degree of choroidal elevation, and some accessory operation might be required; (3) the choroidal elevation might not last sufficiently long to permit the formation of permanent adhesions. The first of these possible disadvantages appeared unlikely; the second was more important, and indeed in one of the cases here reported it was necessary to use the nylon suture recommended by Arruga as an additional step after the gelatin film inclusion; the possibility that the gelatin film might be absorbed too quickly could only be determined by experience.

In order to produce the necessary choroidal indentation, the gelatin film could be placed either between the scleral lamellae or between the sclera and the choroid. The last possibility introduced what appeared to be an unjustifiable danger. It was accordingly decided to adopt the first alternative and place the gelatin film between the scleral lamellae. To accomplish this it was decided to perform a trap-door dissection of the superficial layers of the sclera in the center of which the retinal tear would be projected, thus insuring the inclusion of the tear in the operated field.

It is the purpose of this report to give the results observed in five patients, all with severe retinal detachment, operated upon with the technique to be described, essential steps of which were the intrascleral inclusion of gelatin film to produce the desired choroidal indentation. In all these patients the minimum postoperative period of observation is three months. Patients subsequently operated upon with this technique, but with a shorter period of postoperative observation, will be the subject of a subsequent communication.

Technique

Either local anesthesia with appropriate sedation or general anesthesia is used. After throwing back a conjunctival flap, dissection of the sclera is accomplished without section of the extraocular muscles. These may be pulled to one side with a nylon thread or a hook in order to obtain adequate exposure. The scleral zone in which the tear will be projected is thus exposed, the tear is localized by ophthalmoscopic examination and its projection on the sclera is confirmed by superficial scleral diathermy.

Taking this point as the center, a trap-door is dissected by splitting the sclera through two-thirds of its depth with a Bard-Parker knife and Barraquer's colibri forceps. The surface of the exposed scleral bed is then cauterized with superficial diathermy in the usual manner. Drainage of the subretinal fluid is done either through the cauterized area, or elsewhere where the detachment is at its maximum. The trap-door is now partially closed, using 81/7 Grieshaber needles, Barraquer's colibri forceps, Barraquer's curved needle-holder and 6-0 silk. The gelatin film is then introduced with a spatula into the cavity thus produced. The trap-door is now closed with preplaced sutures, leaving a slight protrusion of the included area. This area loses its elasticity. A sharply localized elevation of the choroid is obtained by this procedure. On ophthalmoscopic examination at the end of operation, the posterior edge of this elevated area is well defined, the lateral edges less so, while, as a rule, the anterior edge cannot be visualized.

The amount of choroidal elevation resulting from this gelatin film implant is from 12 to 30 diopters. When further or permanent elevation is required it may be accomplished by using Arruga's nylon-thread technique, placing the thread over the center of the included area where, theoretically, it should be directly over the tear.

Case reports

Case 1

M. C. C., a 59-year-old woman, one year previously had been subjected to a section of the left trigeminal nerve for facial neuralgia. There was a detachment of the left retina of one and one-half months' duration, with a large retinal tear about two disc diameters in size in the upper temporal field. Preoperative vision was: O.D., 6/10; O.S.

light perception. There were no fixed retinal folds. Operation with the described technique was done on December 12, 1959. The trap-door was approximately 12 by 8.0 mm. in size. At the end of operation, ophthalmoscopic examination showed the retina over the included zone elevated about 12 diopters while the remaining area was seen attached. The postoperative course was uneventful except for a corneal ulcer, probably related to the keratitis neuroparalitica from the preceding trigeminal section. This developed on the 15th day. Under bandaging and local steroids, it cleared within five days. On last examination, more than seven months after operation, the retina was everywhere attached, the fovea was clear, and the corrected vision was: O.D. 6/10; O.S. 3/10.

CASE 2

A. L. M., a 26-year-old woman, with a myopia of four diopters in each eye was in the sixth month of a normal pregnancy. There was a retinal detachment with a tear of one disc diameter in size, in the inferior field, of one month's duration. Best corrected vision was 1/20. Operation with a trap-door 15 by 12 mm. in size was performed on February 16, 1960. Ophthalmoscopic examination at the end of the operation showed the retina was everywhere reattached, the included area was elevated about 15 diopters, with the coagulated tear at its posterior edge. The postoperative course was uneventful and the inflammatory reaction was slight. Five months after operation, the retina was still attached, the fovea was clear and the corrected vision was 10/10.

CASE 3

W. S., a 32-year-old man, had myopia of over 25 diopters in each eye. There was an almost complete detachment of the left retina of one month's duration, with a small, oval tear in the left superior field.The vitreous was moderately fluid. On bedrest, the retina became only partially reattached. Trap-door operation, as described, was done on March 23, 1960. Ophthalmoscopic examination at the end of operation showed the included area was well elevated, but the tear was just on its posterior edge. On the seventh postoperative day, the retina again became detached and the patient was reoperated. The dissection of the scleral lamella was extended backward some millimeters to include the tear, and more gelation film was inserted. At this operation it was found that the gelatin film inserted at the first operation was uniformly distributed, and only slightly diminished in amount. At the end of operation, ophthalmoscopic examination showed the retina was again reattached and the tear was now in the included, elevated area. However, nine days later, the detachment again recurred, and the patient was discharged from the hospital.

CASE 4

A. C., a 62-year-old man, had an almost complete retinal detachment in the right eye, a tear 1.5 disc diameters in size in the upper field, and vision reduced to light perception. The detachment subsided only slightly on bedrest. Trap-door operation as described was done on April 4, 1960, two months after the onset of symptoms. The postoperative inflammatory reaction was greater than in the previous cases and the fundus was difficult to visualize. However, the operated area could be seen; it was elevated about 10 diopters. One month later, the included area was elevated six diopters and, after two months, the elevation had entirely disappeared. The media were now clear and the retina was everywhere attached. The fovea was clear. On last examination the vision was 5/10.

CASE 5

L. E. A., a 62-year-old woman, had high myopia, diabetes and vascular hypertension. There was a total retinal detachment of the left eye of two months' duration, with a small tear in the nasal field, an immature cataract, and, although ophthalmoscopic examination was difficult, retinal folds and traction bands could be identified. Visual acuity in the right eye was 2/10 and in the left eye light perception. Operation was on April 25, 1960. A large trap-door flap was made, with the usual gelatin film implant between the scleral lamellae. On account of the traction bands, a nylon "cerclage" was done after the Arruga technique. At the end of operation, it was still possible to visualize dimly the included area, which was elevated about 30 diopters. The inflammatory reaction was fairly severe but it subsided within two weeks. Three months later the indentation, which was still elevated 20 diopters, could be clearly seen. However, the retina appeared to be everywhere reattached. Vision on discharge was: R.E., 2/10; in the operated eye, 1/10. In both eyes there were diabetic retinal lesions.

COMMENT

The postoperative course in these five patients was essentially the same. The inflammatory reaction was either slight or of medium intensity and subsided within the first two or three weeks. It appeared to be less than that accompanying other more drastic operative procedures designed to achieve the same ends. The protrusion of the retina caused by the gelatin film implant gradually subsided and had almost or completely disappeared within a two- to four-month period. As it subsided, the retina underlying the operated area became pigmented. No untoward symptoms referable to the operation were observed.

The over-all results as concerns a me-

chanical reattachment of the retina were satisfactory. In four out of the five cases reattachment was obtained and this remained after a follow-up period of three to seven months. The reason for failure in Case 3 is not easy to understand. At the conclusion of the second operation, reattachment appeared to have been attained. The area of the tear had been cauterized and appeared to be in contact with the choroid. Perhaps the existence of a second tear, which had been neither detected nor treated, was the explanation for the failure.

This procedure appears to have certain advantages. The most important of these are:

1. It has been successful even without exact localization of the tear. (Case 2, where the tear was at the posterior edge, and Case 5, where the tear could not again be localized at the actual operation, and its projection on the trap-door area was only approximate.)

2. When the absorption of the gelatin film is complete, no foreign substance remains in the eye.

3. The contour of the eye is not permanently deformed.

4. The duration of the choroidal elevation is sufficient to allow organization of chorioretinal adhesions.

5. The postoperative inflammatory reaction is less than in most other scleral shortening or indentation operations.

6. The surgical technique is not difficult.

It is, of course, quite possible that a larger series of cases may disclose disadvantages which were not observed in these first five cases. Further experiences may well modify or disprove the conclusions which now appear justified. However, from the information now at hand, it seems quite probable that the intrascleral inclusion of absorbable gelatin film over the area of the retinal tear may prove to be a valuable addition to retinal detachment surgery.

Summary

A new technique for the surgical treatment of retinal detachment is presented. This consists in the inclusion of absorbable gelatin film between the scleral lamellae. This is designed to achieve and maintain good contact between the retina and the choroid in the tear zone. This intrascleral inclusion is performed following cauterization of the bed of a partially penetrating scleral trap-door over the site of the retinal tear, and the drainage of the subretinal fluid. Five cases, operated upon with this technique and with follow-up periods of from three to seven months, are reported. In four of these the retina was reattached and remained so during the full postoperative course of observation.

The principal advantages of this technique are that it is possible to treat a wide retinal area, and hence is useful even when there is a poor localization of the tear. After a few months, the implanted gelatin film is completely absorbed and no foreign substance remains in the eye. No untoward reactions incidental to this technique have been thus far observed.

While the results to date are highly encouraging, a larger series of cases and longer follow-up periods will be necessary for a final appraisal of this method.

Mercedes 909.

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EFFECT OF PROTOPAM ON THE RABBIT PUPIL*

NARENDRA KRISHNA, M.B.B.S., AND IRVING H. LEOPOLD, M.D.
Philadelphia, Pennsylvania

INTRODUCTION

It has been reported that pyridine-2-aldoxime methiodide (2-PAM, pralidoxime iodide; protopam iodide) counteracts the miosis induced by the local use of anticholinesterase agents in the rabbit and normal human eyes.[1,2] It has even been claimed that it reverses the ocular effects of anticholinesterase agents in the glaucoma patients, that is, it produces dilatation of the miotic pupil and decreases the aqueous outflow facility.[3] In these studies the subconjunctival route of administration of protopam iodide has been found to be most effective. Protopam iodide has been employed as an aqueous solution of 5.0-percent strength, which is the maximum limit of solubility. Based on these studies potential uses in ophthalmology have been suggested.

The availability of the chloride salt, protopam chloride which has a lower molecular weight than protopam iodide suggested that it may have a better ocular penetration than the iodide salt and may even be effective in the form of drops into the eye. Furthermore, because of its extreme solubility it was considered that higher concentrations of the drug could be used, thus achieving maximum effectiveness.[4] Therefore we investigated protopam chloride using protopam iodide (5.0-percent aqueous solution) as the standard and present the result of these investigations here.

METHODS AND RESULTS

Young albino and pigmented rabbits of either sex and of approximately equal weights were used. Maximum miosis was induced by the various anticholinesterase agents in both eyes of rabbits by local instillation (eserine 0.5 percent; prostigmine 5.0 percent; BC-48 0.25 percent; DFP 0.1 percent; phospholine 0.25 percent). After the pupils had become pinpoint, in the right eye which served as the test eye, 0.2 cc. of freshly prepared aqueous solutions of protopam chloride or protopam iodide was employed, and in the left eye, which acted as the control eye, 0.2 cc. of aqueous solution was administered. Observations were made

* From the Department of Ophthalmology, Graduate School of Medicine of the University of Pennsylvania and the Research Department of the Wills Eye Hospital.

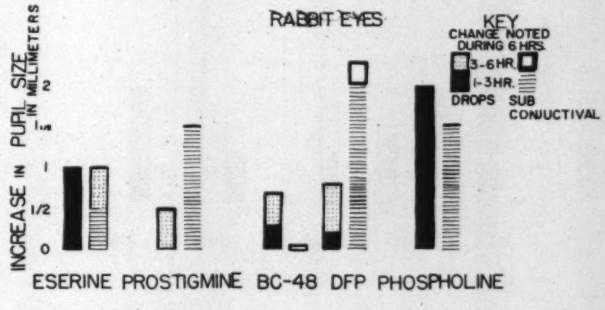

Fig. 1 (Krishna and Leopold). Effect of 30-percent protopam chloride on pupillary size after anticholinesterase agents in rabbit eyes.

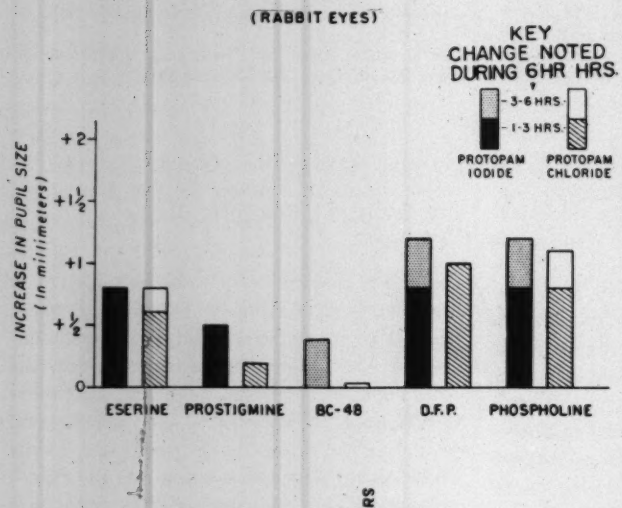

Fig. 2 (Krishna and Leopold). Effect of subconjunctival 5.0-percent protopam chloride and 5.0-percent protopam iodide on pupillary size after anticholineterase agents in rabbit eyes.

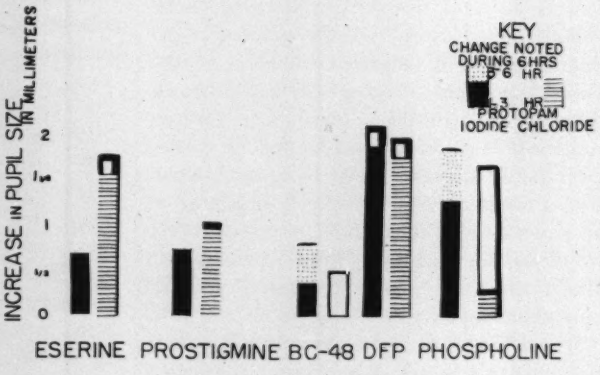

Fig. 3 (Krishna and Leopold). Effect of intracameral 5.0-percent protopam chloride and 5.0-percent protopam iodide on pupillary size after anticholinesterase agents in rabbit eyes.

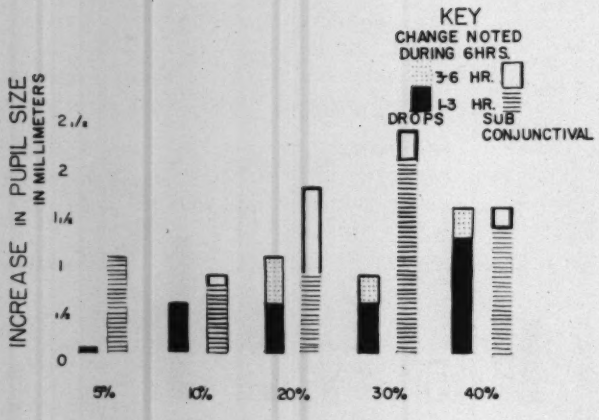

Fig. 4 (Krishna and Leopold). Effect of drops and subconjunctival injections of various concentrations of protopam chloride on pupillary size after DFP in rabbit eyes.

over a six-hour period during which differences between the sizes of the right and left pupils were noted.

The results of these experiments are illustrated in Figures 1 through 4. Each bar in these experiments stands for 12 rabbits. In none of these experiments was there an increase in the pupillary size of the protopam-treated eyes of more than 2.5 mm. as compared to the control eyes. While in most instances maximum dilatation was achieved in three hours, in some this increase continued over a six-hour period. Although maximum effectiveness was noted against DFP- and phospholine-treated eyes, some effect was also noted against eserine, prostigmine and BC-48 (fig. 1). Results of 5.0 percent subconjunctival and intracameral protopam chloride and protopam iodide were about identical (figs. 2 and3). Protopam chloride was more effective when given subconjunctivally than in the form of drops and optimum results were obtained with 30-percent aqueous solution (fig. 4).

Conclusions

Protopam chloride, like protopam iodide, is more effective subconjunctivally rather than in the form of drops. Because of increased solubility it may be used in higher concentrations to achieve increasing effect but this advantage is offset by the increased irritation of the ocular tissues as the strength is increased. The increase in pupillary size by 2.0 to 2.5 mm. both by the iodide and chloride salts of pupils made miotic with anticholinesterase agents, which manifests over a period of six hours, is definite but not marked. The usefulness of protopam chloride and iodide in ophthalmology is limited at present by virtue of their slow reversing effect and necessity of subconjunctival injection.

1601 Spring Garden Street (30).

Acknowledgment

We wish to express our thanks to Dr. Robert A. Lehman of Campbell Pharmaceuticals, Inc., for the supply of protopam iodide and protopam chloride used in this study.

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Ophthalmic Miniature

Federalsburg, Md., December 11, 1888

Dr. J. J. Chisholm:—

Dear Doctor: Some years ago my youngest son had a typical case of measles. Tass, a favorite setter, was in the room with him most of the time. In about two weeks the dog began to cough, had inflammation of the eyes, fever and thirst, all of the usual symptoms of measles, except the rash. I regret I did not look under the hair for that. He was sick about the time it takes a case of measles to run its course in the human subject. The dog recovered its usual health, but with complete loss of hearing, which he has never regained.

Yours truly,
Charles W. Jefferson, M.D.
Med. Record, **35**:126, 1889.

NOTES, CASES, INSTRUMENTS

AN ARM REST*

FOR USE IN OPHTHALMIC SURGERY

ROBERT N. LEHMAN, M.D.
AND
MURRAY F. MCCASLIN, M.D.
Pittsburgh, Pennsylvania

Many eye surgeons who sit when operating use an arm rest to increase steadiness of the hand.[1-2] A rest for this purpose which has proved quite satisfactory was made in the carpentry shop from a two-foot steel plate and a block of wood. The plate was fastened to the bottom of the block with the dimensions indicated (fig. 1-A).

By using two such blocks, a large sturdy arm rest can be placed near each side of the patient's face. If local anesthesia is used, the rests are placed after preparation of the field but before draping. The steel plates are slipped under the mattress on the operating table to bring the blocks to the desired position along each side of the patient's head (fig. 1-B).

The patient is then draped (fig. 1-C and D). The rests do not interfere with draping but are actually found to facilitate it. Use of a narrow pillow brings the arm rests fairly close to the patient's head.

University Drive (40).

* From the Veterans Administration Hospital and the University of Pittsburgh School of Medicine.

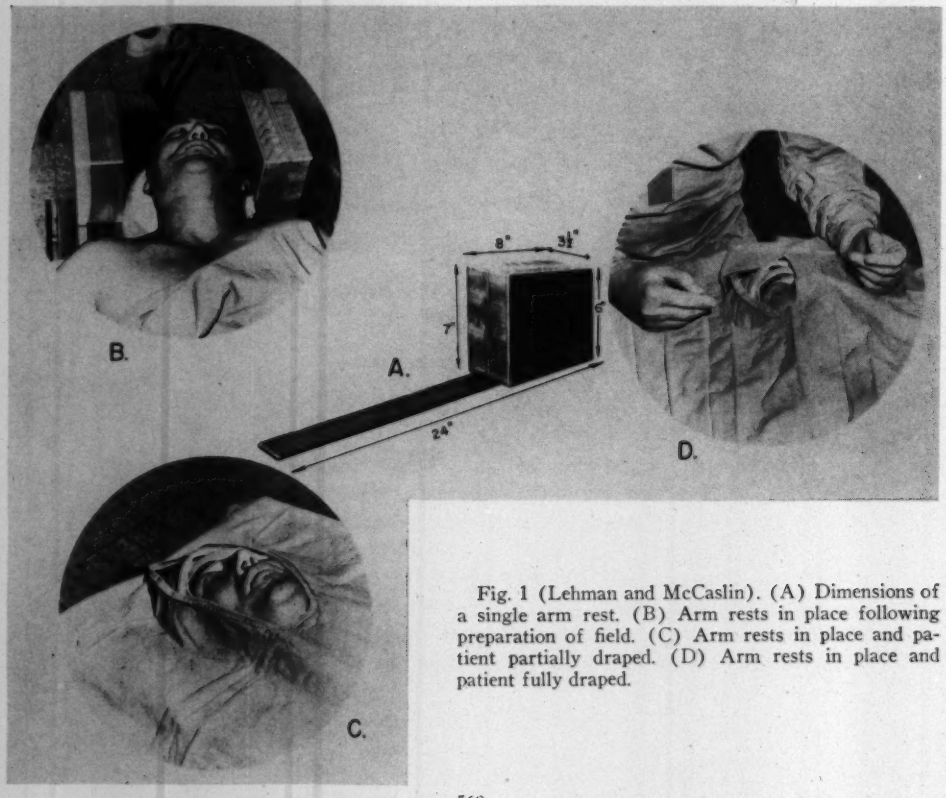

Fig. 1 (Lehman and McCaslin). (A) Dimensions of a single arm rest. (B) Arm rests in place following preparation of field. (C) Arm rests in place and patient partially draped. (D) Arm rests in place and patient fully draped.

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PECULIAR DEFICIENCY OF ANTIBODY PRODUCTION*

IN A PATIENT WITH KERATITIS RECEIVING HERPES-SIMPLEX VIRUS VACCINE

H. BEECHER CHAPIN, M.D.
DANIEL DOCTOR, M.D.
AND
SAM WONG, PH.D.
New York

The purpose of this report is to relate an unusual finding concerning the antibody response in a patient who has been receiving injections of a herpes-simplex virus vaccine.

CASE REPORT

The patient, aged 37 years, a Negro housewife, first noticed an inflammatory condition of the eyes in 1931. This condition recurred in 1938. In 1950 at the Manhattan Eye, Ear and Throat Hospital, an ophthalmologist noted scarring of both corneas. A corneal graft was done on the right eye in August of that year. In conjunction with the surgery, local treatment of steroid, atropine instillation, and other local medication was required, as well as beta-ray therapy.

In 1956, the visual acuity of the right eye was such that the patient could read. Unfortunately in May, 1959, there was an exacerbation of the ulceration of the cornea in the left eye.

It should be mentioned in passing that of the medications used, the patient developed local sensitivity to pilocarpine and Chloromycetin. Diamox caused a dermatitis of the hands and feet.

In hope of influencing the course of the recurring corneal ulceration, subcutaneous injections of a herpes-simplex vaccine prepared in rabbit kidney cell tissue culture were begun. The injections were given at weekly intervals in increasing dosage, and eventually at monthly intervals.

Before these immunizing-desensitizing injections were begun, a blood serum specimen from the patient was studied for antibody content to the herpes-simplex virus. The antibody content as determined by the neutralization technique was found to be absent (negative at 1-5). The antibody level was determined repeatedly at approximately four-week intervals, and at no time was there found to be antibody present, as determined by the neutralizing or by the complement fixation technique. At the end of 14 months after monthly vaccine injections, the patient still seemed incapable of producing antibody to the vaccine antigen material. The inflammatory condition of the left eye cleared and has been absent the past 12 months.

To investigate the patient's lack of immunity response, an electrophoretic study was done October 18, 1959, on the patient's serum at the Institute of Allergy, The Roosevelt Hospital, New York City. Utilizing the Tiselius apparatus, the results were as follows:

Albumin	51.93%
$Alpha_1$	4.09
$Alpha_2$	8.27
Beta	16.11
Gamma	19.62
A/G	1.08
Total protein	7.96

In a patient, aged 37 years, these findings indicate an abnormal serum. The gamma is elevated, and the albumin slightly decreased.

Agglutination studies for bacterial antigen response gave the following results:

Typhoid H	Negative
Typhoid O—1:20	4 plus
Salmonella—1:40	4 plus
Group D—1:80	3 plus
Somatic antigen—1:160	Negative
1:132	Negative
Paratyphoid	Negative
Brucellosis	Negative

The patient had exhibited an immune response of the delayed allergy type to tuberculosis as follows:

Mantoux test	
1:100,000	Negative
1:10,000	2 plus
1:1,000	4 plus

*From the Department of Allergy, Manhattan Eye, Ear and Throat Hospital. The electrophoretic study was done by Arthur E. A. Menzel, Ph.D., and P. A. Meyers, B.A.

Discussion

This patient showed an unexpected lack of response to antibody production of the herpes-simplex vaccine, when compared to the immune response of other patients receiving similar vaccine injections. All the patients with this one exception, showed an increased antibody level following the onset of the immunizing injections. The levels of response varied, some high (1 : 1280) and others lower.

That the patient was capable of an immune response to a bacterial antigen is shown by the agglutination results with typhoid and other bacterial organisms mentioned. An immune response of the delayed allergy type is shown by the tuberculin tests. That an agammaglobulinemia is not present is proved by the serum electrophoretic results. The reason for the peculiar lack of immune response in this patient to a virus antigen is not known.

136 East 64th Street (21).

AN ELECTRONIC OPHTHALMODYNAMOMETER*

Stephen Kelly. M.D.
Birmingham, Alabama

A modification of the electronic tonometer and recorder unit (produced by V. Mueller & Co.) has been devised to allow for the construction of the inevitable electronic ophthalmodynamometer. This adaptation was done for several reasons:

In our hands, although the mechanical ophthalmodynamometer was quite adequate, it had the disadvantage of requiring many consecutive readings, after which an average value for central retinal artery pressure could be taken. It was felt that considerable error could be introduced in this technique, especially if the differential was small. Also, if in the preliminary examination there was strong evidence for a vascular insufficiency to be manifested on one side, a certain amount of unwarranted interpolation was likely to result.

Fig. 1 (Kelly). Note the groove in back of the concave head.

The electronic tonometer was modified so that an ophthalmodynamometer head and lead could be inserted into the outlet of the tonometer lead. The ophthalmodynamometer itself was modified so that a concave plate of 12-mm. radius and eight-mm. diameter was mounted at the tip. The advantage of this head was that it did not allow for as much slippage as the convex head of the Bailliart ophthalmodynamometer. A groove was placed immediately in back of the concave head to allow for stabilization at the

Fig. 2 (Kelly). Scale synchronized with recorder.

* From the Department of Ophthalmology, University of Alabama School of Medicine.

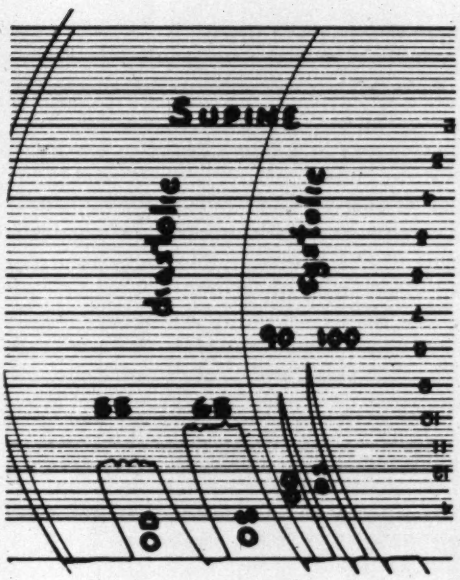

Fig. 3 (Kelly). Graph produced by device.

lateral canthus (fig. 1). The ophthalmodynamometer head was calibrated in gm., and the scale for this device was placed above the tonometer scale and synchronized with the recorder (fig. 2).

To record pressure the ophthalmodynamometer is placed on the side of the globe and continuous steady pressure is maintained until diastolic pulsations are seen. Pressure is then slacked off until pressure is applied just adequate to maintain a steady diastolic pulsation. This produces a graph as indicated in Figure 3. The values are easily measured and the differential is obvious. For systolic readings, to which we seldom resort, pressure is applied to the globe until complete blanching of the vascular tree is achieved. Pressure is then relieved, resulting in a spike curve (fig. 3). It is felt that this device produces an easier and more accurate method of estimating any difference in central retinal artery pressure.

1919 7th Avenue South (3).

CROSS-ACTION CILIA FORCEPS*

ERWIN E. GROSSMANN, M.D.
Milwaukee, Wisconsin

The epilation of misdirected eyelashes is a common office procedure. I have found that, in many instances, the offending lash breaks off (or is cut through) at the point where the forceps jaws grasp it. It may be impossible to re-apply the forceps because of the short stub.

The cross-action cilia forceps herein described has been found never to cut or break the lash, since no direct pressure is necessary

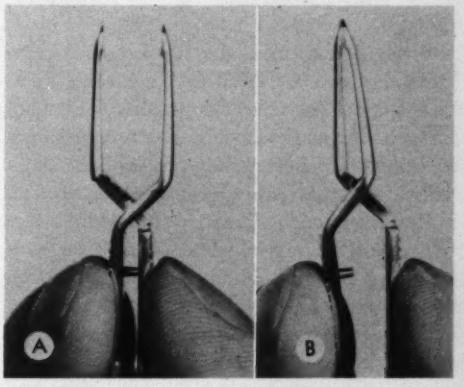

Fig. 1 (Grossmann). Cilia forceps open and closed.

when exerting the tug. The forceps is applied close to the base of the lash with jaws open, then allowed to close over the lash and attach itself by its own cross-action power. This self-clinging power is adequate to hold the lash firmly while being epilated.

Figure 1 shows the forceps open and closed. The instrument measures three and one-fourth inch in length. Its design permits it to be held easily and gently between the forefinger and thumb.

836 North 12th Street (3).

* From the Department of Ophthalmology, Veterans Administration Center, and the Department of Ophthalmology, Marquette University School of Medicine. This instrument is available at the Storz Instrument Company, Saint Louis, Missouri.

SOCIETY PROCEEDINGS

EDITED BY DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

March 7, 1960

ETIOLOGIC FACTORS IN READING DISABILITIES OF CHILDREN

H. K. GOLDBERG, M.D. Baltimore: Children of normal intelligence who show reading difficulties fall into two main groups—those with and without organic brain damage.

Brain damage may be frank, as in cerebral palsy, or subclinical. In these cases there is a basic incapacity to visualize a symbol as such or to associate it with a word or a meaning; they may show no neurologic signs but evidence is present of organic trouble in the developmental history; handedness development is delayed; fine control, such as fastening buttons, is delayed; there is often mirror-writing, and emotional instability with aggression and distractability. There is often a history of prenatal or perinatal maternal complications and often an abnormal EEG; general disorganization with asymmetry, abundant slow activity and occasional sharp waves, all in the parietoccipital area.

The method of teaching reading by sight—or phrase reading (rather than phonetically)—is particularly difficult for this group, since it involves the recognition of whole words or phrases, which they cannot do.

Cases without brain damage are mostly emotional in nature. There may be (a) preschool emotional problems associated with lack of adequate parental relationship, (b) school problems such as language difficulty, frequent change of school, auditory impairment, (c) a vicious circle caused by mild original difficulty but aggravated by the child's, the parent's or the educator's reaction to the slow reading. (The original trouble may be a simple delayed maturity so that the child is not prepared to read at the age of six years but would be soon after.) This group will take care of itself automatically if it is protected from competition and from the stigma of failure.

Moderately defective vision, and muscle imbalance are unimportant as causes of reading disability. They may cause fatigue but not retarded reading.

Treatment. Most cases respond best to much easy reading, with encouragement and lack of pressure from parent and educator.

PANCREATIC DORNASE IN OCULAR INFLAMMATION

ROBERT S. COLES, M.D., New York: Filtrates of streptococcus cultures contain an enzyme, streptodornase, which liquefies pus by breaking down desoxyribonucleoprotein and nucleic acid. As Varidase it is used clinically in local application to wounds. It is too toxic to be used systemically. A similar enzyme derived from pancreas has been found to have the same effect on pus but to be nontoxic when given intravenously or intrathecally.

The present study concerns the toxicity and ocular penetration of pancreatic dornase. Subconjunctival and intravenous injections of large amounts had no deleterious effects on rabbit eyes. Analysis of aqueous showed good penetration after administration by both routes. In humans, subconjunctival injection causes moderate pain and redness. Intravenous injection causes no local symptoms. Aqueous aspiration showed dornase present in the anterior chamber. In rabbits with induced purulent endophthalmitis, dornase is effective in preventing loss of the eye.

Clinical trial on patients with uveitis showed no particular effect. Three cases with purulent endophthalmitis showed equivoca-

results. In hypopyon ulcer, however, it seemed effective in clearing the hypopyon and the base of the ulcer, regardless of the etiology.

CATARACT FORMATION FOLLOWING INTOXICATION WITH STRONTIUM^{90}

ALFRED KESTENBAUM, M.D., New York: During an experiment in 1949, the patient, a physicist, was accidentally exposed to a great amount of new-formed strontium^{90} (Sr^{90}). There was no explosion or irradiation; the strontium was probably inhaled in dust or in droplet form. Ever since that time, Sr^{90} could be found consistently in his urine. At first its concentration was 8.0 micro-micro-curies per liter of urine, or about 10 times the normal. Later, this decreased to 5.5, and later on increased again to 6.6 micro-micro-curies. This increase corresponded with the general increase of Sr^{90} in normal, not especially exposed persons, due to the increased amount of Sr^{90} in the atmosphere. These findings indicated a lasting deposition of Sr^{90} in the patient's body, probably in his bones, since experimental feeding of animals with food containing strontium had resulted in deposition of Sr in the bones. X-ray films of the patient's bones were negative; the patient had no subjective complaints.

His eyes, under observation since 1955, were normal: O.D., 20/20; O.S., 20/20. In October, 1958, the patient noticed a decrease in vision and monocular diplopia in his right eye. Examination revealed slight myopia, well-defined opacities in the posterior cortex of the lens of the right eye, and a very slight opacity in the left lens. After correction, his vision was: O.D., 20/30; O.S., 20/20. Within five months, the cataract of the right eye progressed almost to maturity. Blood sugar was normal. The absence of any other known etiology, the relatively young age of the patient, and the history indicated the possibility of a causal connection between the cataract formation and the old Sr^{90} intoxication. One had to consider the close chemical relationship of strontium and calcium, the parallel physiologic behavior of Sr and Ca in their deposition in the bones, the cataract in tetany in which severely decreased calcium in the blood is found, together with increased deposition of calcium in the long bones and with highly increased calcium in the lenses (up to 150 times). On the basis of these facts, the hypothesis was made that, in the present case, the Sr^{90} taken in by the patient was deposited not only in the bones but also in the lenses, and that this deposition of Sr in the lenses was responsible for the cataract formation.

Extracapsular extraction of the cataract of the right eye in May, 1959, resulted in a vision of more than 20/20 with correction. Use of a contact lens allowed co-operation with the other eye which still had a vision of 20/20.

Examination of the extracted lens material revealed the presence of strong beta radiation. The beta radiation curve showed an energy characteristic of yttrium^{90}, the decay substance of strontium.^{90} Chemical examination showed the presence of a relatively high amount of strontium in the lens material.

Hence, in this case, in which Sr^{90} had been introduced into the body by intake, not by irradiation, the deposition of Sr^{90} in the lens was proven directly, both physically and chemically, and thus evidence was found for a causal relationship between this deposition of Sr^{90} in the lens and the cataract formation.

Alan H. Barnert,
Corresponding Secretary.

YALE UNIVERSITY POSTGRADUATE SERIES

January 29, 1960

R. M. FASANELLA, M.D., *presiding*

TREATMENT OF RETINOBLASTOMA

NORAH DUV. TAPLEY, M.D.: The material covered in Dr. Tapley's lecture was described in the article entitled, "Treatment of

retinoblastoma by X-ray and triethylene melamine" which appeared the *AMA Archives of Ophthalmology*, November, 1958, vol. 60.

Discussion. DR. FASANELLA: In November, 1959, I spent some time in Germany with Dr. Meyer-Schwickerath. Because retinoblastoma is a white and nonpigmented tumor, he approached the treatment of this type of tumor with some reluctance and trepidation. The light coagulator works best where pigment is present. Dr. Meyer-Schwickerath will not use light coagulation in the following cases: (1) near the disc, (2) near the macula, (3) if larger than eight disc diameters, and (4) if one cannot see beyond the periphery of the tumor. Tumors in these categories are best treated by enucleation or a combination of T.E.M. (or other chemicals) and/or X-rays.

The present method used in treating suitable tumors with light coagulation is (1) to destroy the blood vessels feeding the tumor, (2) put a ring of light coagulation of a low intensity around the tumor and (3) to hit the surface of the tumor itself with a high intensity (or use a normal intensity for twice the normal time).

If there are small tumors in both eyes, Dr. Meyer-Schwickerath would use light coagulation in both eyes. He feels that light coagulation is a good auxiliary to other methods. In November, 1959, he felt that a combination in the following order of treatment was the best: (1) T.E.M., (2) X-rays, (3) light coagulation. This combination reduced the amount of T.E.M. (or other chemicals), the amount of X-ray and the intensity and amount of light coagulation needed.

DR. WIES: Fortunately we see too few cases but I remember a little girl we had 10 years ago in whom we did a bilateral enucleation. The child is still alive, remains healthy, and looks fine with prosthesis. I believe photocoagulation may be useful in the second eye if the lesion is small. However, when we see cases of retinoblastoma, most of them are highly advanced.

DR. LEIB asked whether parents are advised not to have children. Is this tumor seen in children of parents with retinoblastoma?

DR. TAPLEY replied that of 35 offspring from 29 parents with this tumor 80 percent has retinoblastoma. They must be told what may happen.

DR. KLIGERMAN added that much time is spent on these patients so they will understand the problem. Much use is made of the social services to meet the multiple related problems.

DR. TAPLEY indicated that the old dose of X-rays was too high, now in failure one can repeat smaller doses which totally are less than the previous total dose. These tumors remain encapsulated in the eye for some time so it is worth-while to try coagulation and other means.

Stephen Troubalos,
Recording Secretary.

OPHTHALMIC MINIATURE

He had a sufficient smattering of physiology to know that the last picture that was focused on the Constable's retina was a picture of himself; and his modern superstitious credulity as to the possibility of this picture, or rather these two co-ordinated pictures, being photographed in the laboratory and used to identify him led him to destroy the dead man's eyes with two more careful shots.

George Bernard Shaw,
"On the Entirely Reasonable Murder of a Police Constable,"
Sunday Express, 13 May, 1928.

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RETINITIS PIGMENTOSA AND CONGENITAL DEAFNESS*

Retinitis pigmentosa is the classical example of a condition, at first sight unitary, which may be caused by several different mutant genes. Some affected families show the pattern given by an autosomal recessive, others that given by a dominant, and still others that given by a sex-linked recessive gene.[1] In addition, there are distinct mutant genes which cause retinitis pigmentosa in association with other abnormalities. Just over a hundred years ago, von Graefe[2] reported the association of retinitis pigmentosa and congenital deafness in three of a family

* Reprinted from *The Lancet,* March 26, 1960, pages 688 and 689.

of five. Julia Bell,[3] in 1933 collected 93 recorded instances of this association. In 1945 Lindenov[4] confirmed that the syndrome was almost certainly due to an autosomal recessive, and showed that it was responsible for about six percent of cases of congenital deafness in Copenhagen and the adjoining counties; hence it may be inferred that the prevalence of the condition there was of the order of three per 100,000. Hallgren[5] has made a new study of the syndrome in Sweden, attempting to ascertain all the cases in the country. The admirable Swedish system of medical and social support for the deaf of all ages enabled him to identify 151 living patients—which probably represents the majority in the country over the age of 10 years, and a high proportion of those younger than this. The prevalence over the whole country was 2.4 per 100,000, which is close to Lindenov's figures for Denmark. The disorder is commoner in the more sparsely populated northern counties of Sweden than in the south. In the three most northern counties, the prevalence was found to be over one in 10,000; whereas in Stockholm there were only three cases in a population of over half a million.

Besides the two main features of the syndrome, vestibular ataxia, cataract, mental defect, and psychosis may be found. Cataract, which develops in the majority of patients over the age of 40 years, may be regarded as another manifestation of the gene. The majority of patients show ataxia in the form of a swinging gait; the degree of this ataxia is related to the degree of hearing loss, and Hallgren showed that it is probably due to loss of labyrinthine function. The question whether true mental deficiency is associated with the syndrome is not easily answered, because of the handicap of congenital deafness. Hallgren tried to overcome this difficulty by comparing the abilities of his patients with those of patients with congenital deafness of other types. He considered that over 20 percent were, to some degree, mentally retarded, but that only two to three percent were imbeciles or idiots. This does, however, suggest a real genetic association with mental deficiency. The incidence of psychosis—mainly schizophrenic-like illnesses—in the patients was also over 20 percent. This may reasonably be attributed to the stress of congenital deafness and the inexorably progressive loss of vision in early adult life.

Hallgren has also made a genetic analysis, which is especially valuable since it is based on much the largest consecutive series of patients. He confirms that a recessive mutant gene is the cause. The proportion affected among the sibs of propositi is close to one in four: about a third of the propositi are the products of consanguineous marriages, and a sixth the product of first-cousin marriages. The frequency of the heterozygous carriers of the gene is estimated to be between one in 200 and one in 100. Genealogical investigation showed that there were ancestral connections between 30 of the 102 families. One large pedigree contained no less than 12 affected sibships.

The control of recessively determined disorders of this kind depends essentially on detection of the heterozygous carrier. Hallgren found no clinical manifestations of the gene in heterozygotes; and detection of these carriers may have to wait until the exact nature of the underlying gene-determined chemical abnormality is discovered.

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CORRESPONDENCE

Need in India

Editor,
American Journal of Ophthalmology:

You and I share a professional specialty, so I believe I will have your understanding and compassionate thought for the task that confronts ophthalmology in my present locale. Here in the villages of India, ophthalmology faces an opportunity of staggering dimensions. And here the relation of ophthalmology to human values is made so directly and dramatically apparent.

You will understand why when you visualize the India countryside, devoid of modern conveniences, life is so elemental for all that there is no surplus in home or community to cushion the loss of self-dependence that comes to the blind in India. The loss of spirit and self-respect is tragic—the blind are dependent on the whims of someone for even the elementary necessities of living. They eat without even being able to brush away the insects that so readily come to share their food!

The ophthalmologic opportunity in the India village is as large as the need is dire. There are at least a million people to whom human dignity and productive ability can be restored with a cataract operation. It is difficult to appraise this in dollars, as the annual productive income per capita is exceedingly low, perhaps $58.00. However, the India government and the All-India Ophthalmological Society have been appraised of the fact, in discussions, that India's blind represent a recoverable economic asset of about two billion dollars.

Such a grandiose opportunity should attract the support of influential governments and wealthy foundations, but the fact is that the work to date depends upon a very few, and primarily those of religious zeal. So I feel a compulsion to bring to the mind and hearts of my fellow ophthalmologists this clean-cut, dramatic and immense opportunity to demonstrate the basic importance of our profession, because here the blessings of ophthalmology stand out so clearly—unobscured by the complexity of the prosperous life.

The opportunity and the needs are twofold: First, financial support—no matter how small—can do much good. On the record, the Village Eye Clinics of India restore sight at the cost of $10.00 per eye, and less! Second: the Eye Clinics enable the training of Indian ophthalmologic surgeons and technicians, so that American help even in a small way fosters a growth of professional skills and attitudes that will eventually sustain itself.

I ask your help in whatever way and form you are able to give it. From my experience, the blessings you provide for the Indian blind will return to you in a manifold manner. I hope, too, that you can give me your professional understanding and interest, so that others may come to know that the help they give (which may be modest in their sight) can produce fantastically great values in human dignity, self-respect and life itself for the blind in India.

(Signed) Victor C. Rambo, M.D.,
Eye Service to the Villages,
Eye Department,
Christian Medical College,
Ludhiana, Punjab, India.

Decompression of optic canal

Editor,
American Journal of Ophthalmology:

In The Journal, **51**:659 (April) 1961, was published a paper by Niho, et al., on "Decompression of the optic canal by the transethmoidal route." In their introduction, the authors said "until the present time, the decompression of the fractured optic canal has been made only through the transfrontal route." I wish to point out that, in 1953, I published a paper, "Orbitale Dekompression des knöchernen Sehnervenkanals mit Incision der Duralscheide als ein operatives Verfahren beim retrobulbären Neuritis," in

Bericht über die Zusammenkunft der Deutschen Ophth. Ges. (Heidelberg).

(Signed). V. Čavka,
University of Belgrad,
Belgrad, Jugoslavia.

BOOK REVIEWS

OPTICS: AN INTRODUCTION FOR OPHTHALMOLOGISTS. By Kenneth N. Ogle, Ph.D. Springfield, Ill., Charles C Thomas, 1961. 265 pages, 179 figures, bibliography, index. Price: $8.75.

The author, a valued member of the American Committee on Optics and Visual Physiology, is an authority on whom ophthalmology has relied since the exciting days of the Dartmouth Eye Institute. For years as consultant in visual optics at the Mayo Clinic he has been instructing the fellows in the Section of Ophthalmology. His lectures, on which this book is based, covered the subject in an adequate but streamlined manner, rigidly omitting all exotic material. For instance, in the nomenclature of prisms, centrad is mentioned in a footnote but is not discussed. Ogle, however, does not consider the derivations of the basic formulas as irrelevant. Optics, like other branches of physics, is dependent on mathematics. The inter-relations are so close that many mistakenly classify the physicist Einstein as a mathematician, and the mathematicians, Euler, Sturm and Gauss, as optical physicists.

The author stresses the undesirable properties of ophthalmic prisms. The visual field toward the apex of a prism is smaller than that toward the base. Prisms base-in frequently produce a "bulging" of the print in the middle of the page. In the vertex refraction trial-cases of today, if only a cylinder is needed, a zero diopter sphere must be used with it for the utmost in precision. A welcome innovation is the chapter on the principles of illumination. That on optical instruments includes the lensometer, but the universally used slitlamp deserves more space.

A student who assimilates the essentials presented, works out the exercises appended to each section, and consults the bibliography cited will be well equipped to pass the examination of the American Board of Ophthalmology, to handle problems in clinical optics in practice, and to add perhaps original contributions to this field.

James E. Lebensohn.

VISION OF INTERMITTENT LIGHT: Laws and Mechanisms of Critical Fusion Frequency. By Henri Piéron. Paris, Centre National de la Recherche Scientifique, 1961. 91 pages, 29 figures, bibliography. Paperbound. Price: 8.50 NF.

The literature on critical fusion frequency is extremely vast. *Physiological Reviews* (1955) cites more than 2,000 references. The Belgian, Plateau, in his doctorate thesis (1829) first measured accurately the duration of a light impression. Utilizing critical fusion frequency, he reported a value of 0.19 second. He also noted that fusion produces a sensation of uniform brightness, the resultant being the mean of the periodic impressions (Talbot-Plateau law). Ferry, in 1892, concluded that the persistence of an image varied inversely as the logarithm of the luminosity. Piéron, in 1922, figured more accurately that the time varied as the fourth root of the luminosity for the photopic mechanism and as the seventh root of the luminosity for the scotopic mechanism—a calculation confirmed by Selig Hecht two years later.

This monograph is the eighth of a series of French psychologic monographs published under the auspices of the Minister of Education. It is the 11th contribution by Prof. Piéron on critical fusion frequency since 1920. Piéron reviews briefly the data, shows the inter-relationship of the various laws and presents a general synthesis.

James E. Lebensohn.

ALLOXAN DIABETES IN THE PREGNANT MOUSE. By M. Koskenoja. Helsinki, Oy Weilin and Goos, 1961. 92 pages, bibliography, index. Price: Not given.

This monograph which is also supplement 68 to the 1961 *Acta Ophthalmologica* concerns itself primarily with the effect of alloxan on offspring survival in mice. However, the eyes of these newborn mice were examined as part of the study and the authors confirmed experimentally the clinical impression that the offspring of diabetic mothers show a greater incidence of eye anomalies than do those of nondiabetic mothers. The anomalies consisted of zonular lens opacities and deformations of the iris. The latter, however, occurred only when the mice were made diabetic with alloxan before pregnancy and not when the alloxan was given during pregnancy. Furthermore, these iris anomalies were easily produced by inbreeding without alloxan.

David Shoch.

TRANSACTIONS OF THE CANADIAN OPHTHALMOLOGICAL SOCIETY. 23rd annual meeting, June 12-15, 1960, Vol. 23. Toronto, University of Toronto Press, 1961. 234 pages. Price: Not listed.

The 1960 *Transactions* of the Canadian Ophthalmological Society include the papers presented at the 23rd annual meeting held in that year at Jasper, Alberta. As usual these papers maintain a high standard of scientific ophthalmologic progress.

The opening paper presents a very interesting study of after-image scotometry by J. C. Locke. He found an adaptive disturbance of the peripapillary retina in eyes with early glaucoma, perhaps even before visual field changes. J. François of Ghent, Belgium, discusses the "Significance of electroretinography in diagnosis of blindness in the newborn." He believes that this method of examination makes it possible to differentiate cortical from retinal blindness when the latter does not result in demonstrable ophthalmoscopic change. Boyd and de Margerie attempt to correlate "Retinal artery calibre with blood pressure and age." Their results suggest that narrowing of the arteries is more prominent in youth than old age in patients with hypertension. Howard Reed analyzes blood groups in patients with cataract without any conclusive result. J. H. Doggart of London presents two papers, one dealing with "Ocular manifestations of systemic disease during infancy and childhood," the other on "Obesity and ophthalmology." In a report on "Enophthalmos and diplopia in fractures of the floor of the orbit," J. C. Hill, et al., describe a case successfully treated with insertion of a polyethylene conformer and fascia lata. C. F. A. Culling and associates report a new method of preparing "Sections and museum specimens of eyes using a polyester resin."

R. A. Bourne and S. T. Adams report on 17 glaucomatous eyes surgically treated by the Scheie procedure, of which only six were controlled postoperatively, although the series included three cases of hemorrhagic glaucoma. "Diurnal phasic variation of intraocular pressure" was studied and is reported by S. M. Drance, who found that two out of three cases of glaucoma revealed the highest tension outside of office hours. An extensive paper on "Persistent hyperplastic primary vitreous" is presented by François. Additional papers are by Reed and Platts on "The self-sterilizing properties of the vitreous"; by C. M. Shafto on "Rhabdomyosarcoma"; by S. M. Drance on the "Significance of changes in scleral rigidity during the water provocative test"; three papers on "Retinal detachment" by Mortimer Macrae, S. T. Adams, and M. Shea; "Familial corneal dystrophy" by R. M. Ramsay, and "A five-year study of 200 cases of strabismus" by Samis and Abstikattis.

William A. Mann.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

10
CRYSTALLINE LENS

Barraquer, Joaquin. **Enzymatic zonulolysis in lens extraction.** A.M.A. Arch. Ophth. 66:32-37, July, 1961.

One complication can be attributed to the use of the enzyme and that is delayed wound healing. This can be prevented by proper technique and instrumentation. Use of the enzyme makes lens extraction much easier in patients from 30 to 60 years of age. When the patient is over 60 years of age, the extraction is usually no problem without it and under 30 there is increasing difficulty with decreasing age of the patient. In children under 10 years of age intracapsular extraction is not recommended. (11 figures, 6 references) Edward U. Murphy.

D'Ombrain, A. **Canine cataract.** Med. J. Aust. 1:906, 1961.

A Yorkshire terrior age eight years developed bilateral cataracts. Although this corresponded to a human age of 55 years and the cataracts were considered to be of "senile" type, good vision was obtained by discission. Ronald Lowe.

Galin, M. A., Baras, I. and Perry, R. **Intraocular pressure following cataract extraction.** A.M.A. Arch. Ophth. 66:106-111, July, 1961.

The pressure was measured with the applanation tonometer starting eight hours after surgery. The anterior chamber is usually well-formed by that time and the pressure rapidly approaches the preoperative level during the first day and remains in that range for at least the first week. (2 figures, 3 tables, 12 references) Edward U. Murphy.

Gartner, Samuel. **Methods of inducing complete local anesthesia for cataract surgery.** A.M.A. Arch. Ophth. 66:102-105, July, 1961.

The use of local anesthesia is urged in preference to general anesthesia which has a definite morbidity and mortality. The author recommends two retrobulbar injections, one in the lower temporal region into the muscle cone, and the other above and nasally to the trochlear nerve. Additional injections for each rectus muscle are also advised. This is followed by digital pressure for three minutes and then measurement of the ocular tension with a tonometer. If the tension is above 20 mm. pressure is continued. (4 figures, 11 references) Edward U. Murphy.

Hanna, C. and O'Brien, J. E. **Cell production and migration in the epithelial layer of the lens.** A.M.A. Arch. Ophth. 66:129-133, July, 1961.

Thymidine-tritium was injected into the anterior chamber of the eyes of mice, rats, and guinea pigs and the dividing lens epithelial cells thus labeled. Cell movement was followed by autoradiographic film techniques on histologic sections. (3 figures, 9 references)

Edward U. Murphy.

Keith, C. G. **Intravenous urea in glaucoma.** Brit. J. Ophth. 45:307-311, April, 1961.

The use of urea is not recommended in kidney failure, but otherwise there are few toxic reactions.

Freshly prepared 30-percent urea in a 10-percent solution of invert sugar was administered intravenously at the rate of 30 to 40 drops per minute, to three diamox-resistant patients. The total dosage was between one and 1.5 gr. urea per Kg. of body weight. After 30 minutes the eye is usually soft and surgery may be performed. (3 figures, 10 references)

I. E. Gaynon.

Krwawicz, T. **Intracapsular extraction of intumescent cataract by application of low temperature.** Brit. J. Ophth. 45:279-283, April, 1961.

A pencil-shaped ball-tipped copper- and nickel-plated instrument is placed in a mixture of dry ice and methyl alcohol. A temperature of −79° C. is obtained. The instrument is insulated with silk except for the ball point. The tip is applied to the ice-coated lens capsule at 12-o'clock near the equator. The area in contact freezes and becomes adherent. The zonule fibers are broken by rotary movements and the lens is delivered by sliding. Fifty intumescent cataracts were removed. (6 figures, 7 references)

I. E. Gaynon.

Paulus, W., Hockwin, O. and Kleifeld, O. **Enzymatic determination of "true glucose" in lenses. The control of glucose concentration in bovine lenses.** Arch. f. Ophth. 163:309-313, 1961.

The concentration of glucose in lenses of cattle and calves, as determined by the authors' method, is 1 to 2 mg. percent. It remains unchanged by culture in media containing 120 mg. percent glucose (with or without phosphate) 300 mg. percent glucose, or by X-ray irradiation during the culture. The concentration of free glucose increases in media containing 600 mg. percent glucose. (2 tables, 11 references

Harri H. Markiewitz.

Paulus, W. **Studies on the contents of α-ketoglutaric acid in the cortex and nucleus of bovine lenses.** Arch. f. Ophth. 163:320-323, 1961.

With the help of the author's optico-enzymic method this concentration could be measured accurately. It was found higher in the cortex than in the nucleus, and lower in cattle than in calves. (1 table, 10 references)

Harri H. Markiewitz.

Testa, M. and Delogu, A. **Hexosamine and pentoses content in normal human lenses.** Boll. d'ocul. 39:740-746, Oct., 1960.

The authors determined the presence and amount of hexosamine and pentoses in normal, clear human lenses. They found these values to be fairly constant in all age groups, but reduced from 30 to 50 percent in cataractous lenses. (1 table, 10 references)

Joseph E. Alfano.

11
RETINA AND VITREOUS

Ashton, N. and Black, R. **Studies on developing retinal vessels. VIII. Effect of oxygen on the retinal vessels of the ratling.** Brit. J. Ophth. 45:321-340, May, 1961.

Since the determination in 1953 that the retinal vessels of kittens were greatly affected by high concentrations of oxygen and again affected by return to air, many simlar studies have been made on the retinas of ratlings with conflicting reports of results. Since infant rats would be a more convenient laboratory animal than the kitten, this series of retinal vessel studies was done to determine the effect of the hyperoxia on the ratling.

As a first consideration, it was determined that anatomically these retinal vessels differ in form and arrangement and also in development from those in man and in the kitten. A total of 174 ratlings was used at ages varying from birth to 11 days and in varying periods in oxygen followed by no air and followed by air as well as with and without air after the oxygen. In animals which survived hyperoxia without air a star-shaped pattern of avascular tissue developed as a result of obliteration of the superficial capillary net at the posterior pole; in the younger animals growth of the capillary net was arrested as was also true to some extent in the older animals. The growth of the main retinal vessels and of the peripheral capillaries was not appreciably affected.

In hyperoxia with air survival the anterior periarterial capillary-free zone returned to its normal width; the closed superficial capillaries at the posterior pole neither reopened nor reformed. In contrast, the deep capillary net at the posterior pole redeveloped in a direction toward the optic disc. In hyperoxia with or without air survival no appreciable vessel changes were noted.

These findings differ greatly from those published in earlier experiments with kittens and with human clinical studies and it is concluded that ratlings are not suitable animals for the study of retrolental fibroplasia. (15 figures, 3 tables, 17 references) Morris Kaplan.

Brindley, B. I. and Collins, J. D. **Bilateral retinoblastoma in identical twins.** A.M.A. Arch. Ophth. **66**:63-67, July, 1961.

Two cases are reported and the literature is reviewed. Bilateral enucleation was done and the subsequent course of the twins described, who have survived five years to date. (6 figures, 13 references) Edward U. Murphy.

Estupinan, C. **Retinal cysts.** Rev. oto-neuro-oftal. Sudam. **36**:20-22, Jan.-March, 1961.

The case history of a patient is presented who was first seen in the last stages of an acute chorioretinal inflammation in one eye; when she was reexamined a few months later some retinal cysts had developed in this area. As there were no complications such as hemorrhages, detachment of the retina or secondary glaucoma, no treatment was prescribed. The author also reviews briefly the different retinal cysts from an anatomic, etiologic and clinical standpoint. (2 figures) Walter Mayer.

Hervouet, F. **Abnormalities found in eyes with idiopathic retinal detachment.** Bull. et. mem. Soc. franç. d'opht. **72**:634-646, 1959.

This very interesting pathologic study was based on the investigation of eyes with early retinal detachment. The eyes were enucleated because of the clinical impression of an intraocular tumor. A series of anomalies were found which were rarely described before and which may very well have been congenital. There were foldings and reduplications of the pigment epithelium, anomalies of the choriocapillaris with neovascularization of larger vascular units, invaginations of the membrane of Bruch into the choroid, and separation of the retina from the pigment epithelium by aberrant bundles of nerve fibers. In spite of the progress in the indications and successful

performance of surgery for retinal detachment, there are still a certain number of cases, about 20 percent, which do not respond to the various operative procedures. Congenital malformations or acquired anomalies could eventually explain the tendency toward separation of the two layers of the primary optic vesicle and the difficulties to achieve secondary reattachment. Similar changes also could be the cause of the hereditary detachment and of some cases of bilateral detachment. Anatomic abnormalities of this kind might also explain the difficulty in managing some idiopathic retinal detachments. (11 figures)

Alice R. Deutsch.

Lijo Pavia, J. and Marcone, G. **Human macula lutea.** Rev. oto-neuro-oftal. Sudam. **36**:5-16, Jan.-March, 1961.

This is the second in a series of papers on the macula by these authors. They discuss the percentages of visual acuity in relation to the Snellen chart, as well as the different types of optotypes commonly used. They then discuss the determination of the objective visual acuity through the optokinetic nystagmus and the apparatus used for its production. The final portion of the paper deals with the changes in visual acuity from birth to later years, correlating the values with the development of the macular function during these years. (4 figures)

Walter Mayer.

Lincoff, H. A. **The prophylactic treatment of retinal detachment.** A.M.A. Arch. Ophth. **66**:74-86, July, 1961.

This subject is discussed extensively from the standpoints of retinal holes, pigment demarcation lines, macular holes, areas of degeneration, and cataractous eyes in which a detachment followed cataract extraction in the other eye. These conditions threaten detachment and prophylactic treatment should be considered. (18 figures, 10 references)

Edward U. Murphy.

Mizuno, Katsuyoshi. **Studies on etiology and treatment of retinitis pigmentosa.** Jap. J. Ophth. **5**:19-28, April-June, 1961.

Chemical analysis of A, NA, and D in normal retina and retina poisoned with MIA was performed. Concentrations of A, NA, and D in rabbit retinas made toxic increased from two to five days, whereas in the normal retinas these concentrations remained the same. The concentration of A in rabbit retina before and after the intravenous injection of A showed no appreciable difference. Ophthalmoscopic and histologic studies on the experimental degeneration of retinas by intravitreous injection of CA, AD, and their analogues were investigated. A and NA caused retinal degeneration similar to human and rabbit retinitis pigmentosa, while dopa, tyrosine, and tyramine only caused mild retinal damage. The injury to the retina caused by CA was confined to the visual cells, the ganglion cells sometimes being simultaneously affected. AC caused marked and rapid disappearance of the visual cells and the outer nuclear layer of the retina after an intravitreous injection, while dopachrome, β-naphthoquinone, and o-benzoquinone caused mild damage to the visual cells. It is suggested that CA and AC are specific and selective agents that cause the visual cell death of retinitis pigmentosa. Effect of Catalin on the prognosis of experimental and human retinitis pigmentosa was observed. This new drug delayed development of experimental retinitis pigmentosa and improved visual function of human retinitis pigmentosa except for advanced cases. (5 figures, 2 tables, 8 references) F. H. Haessler.

Stucchi, C. A. **Pseudo retinitis pigmentosa associated with Behçet disease.** Ann. d'ocul. **194**:492-498, June, 1961.

The patient reported here presented a typical Behçet's syndrome involving the skin, mucous membrane, the joints, the genitalia, and the nervous system. Apparently as part of the latter involvement he also showed an unusual type of pigmentary degeneration of the right eye.

A drawing of the fundus is given as well as the visual field, the dark adaptation curve, and the electroretinogram. The author feels that this case represents a pseudoretinitis pigmentosa, probably on a viral basis and therefore acquired. (4 figures, 32 references) David Shoch.

Thomas, C., Cordier, J. and Algan, B. **Retinal vascular lesions of richettsial origin.** Bull. et. mem. Soc. franç. d'opht. **72**: 621-634, 1959.

The etiological survey of diverse eye diseases is of great importance to the clinician, but has been proven very unsatisfactory in the past. Richettsias are known by their angiotropism, and they were suspected to be the cause of a number of cardio-vascular diseases. Based on those reports, a systematic study was undertaken at the Clinique Ophthalmologique de Nancy. The micro-agglutination technique by Girond was applied to test the blood of 30 patients with retinal vascular disease of unknown etiology. This test was found to be positive in five patients, including three with branch thrombosis of the retinal vein, one with arteritis retinae, and one with retinal hemorrhages. These five case histories are reviewed in detail. It is emphasized that all five patients were in good general health. Therefore the question was asked if a richettsial agent could cause a monosymptomatic, ocular disease, and if so, could this disease be the single expression of a primary richettsial infection or the unique manifestation of a recurrence. Abnormalities of the retinal vessels of varying severity have been observed during the acute stage in the course of the classical richettsial diseases and also as an aftermath. It has been proved that richettsias may remain dormant in an individual for a long time without causing any symptoms. Alice R. Deutsch.

Ueno, Ken-ichi. **Morphogenesis of the retinal cone studied with the electron microscope.** Jap. J. Ophth. **5**:38-46, April-June, 1961.

These very detailed observations were made on the tissues of the chicken embryo. (12 figures, 11 references)

F. H. Haessler.

Valk, L. E. M. **The favorable effect of Durabolin (P.P.N.A.-phenylpropionate de norandrostenolon) on diabetic retinopathy.** Bull. et mem. Soc. franç. d'opht. **72**:596-608, 1959.

Valk discusses the treatment of diabetic retinopathy by reducing the activities of the pituitary gland without destroying it. Durabolin P.P.N.A. is an anabolic agent which in therapeutic doses, namely 25 mg. per week intramuscularly, does not cause virilism. It changes a negative nitrogen balance to a mildly positive one and seems to protect the normal proteins from an abnormally rapid decomposition. It also is helpful in weight control. The study of the author is based on 12 patients whose fundus findings were carefully charted. The fundus pictures were classified according to Scott's grouping, and are presented in tables. The results were promising. An appeal was made to use this drug in larger institutions to establish its values in diabetic retinopathy in various stages. (14 figures, 24 references)

Alice R. Deutsch.

Walter, C. J. **Retinopathy following chloroquine therapy.** Med. J. Aust. **I**:741, 1961.

The author describes one patient who developed blurred vision while receiving

chloroquine therapy for lupus erythematosis. His corneas were clear. Fine pigment surrounded both maculas and an absolute paracentral ring scotoma was present in both visual fields. The conditions have been stationary for 12 months despite the substitution of prednisolone for chloroquine. Ronald Lowe.

Zuccoli, A. **A new prophylactic surgical treatment for retinal detachment.** Bull. et mem. Soc. franç. d'opt. **72**:609-620, 1959.

The prophylactic treatment of retinal detachment has been and still is a very controversial subject in view of the potential dangers of any of the procedures in use. At the International Congress in Brussels, however, certain indications were recognized in favor of such an operation. Bilateral retinal detachment predominantly threatens three groups of eyes. Young emmetropes or hypermetropes with oral disinsertion, high myopes, and aphakics with retinal detachment in one eye are in great danger of a bilateral affiliction. In selected cases surgical interventions, photo-coagulation, galvanocauterization, or diathermy may be indicated. The technique suggested in this study is the transconjunctival diathermy coagulation in the region of the equator. About 50 coagulations are applied circumferentially around the eyeball; cooling-off periods are used for ophthalmoscopic examination. Twelve patients were successfully treated; three histories are reviewed in detail. Potential lacerations or hole formations in the intermediary zone do not speak against the final value of the operation; such holes have been found and they remained quiet and therefore are proof of the efficiency of this equatorial barrage. The pyrometrie electrode used in every case permits an exact temperature control and obviates possible severe bleeding. (6 figures, 13 references)

Alice R. Deutsch.

12
OPTIC NERVE AND CHIASM

Massin, M. **Should an optic nerve lesion be treated if it follows a cranio-cerebral contusion?** Bull. et mem. Soc. franç. d'opht. **72**:435-444, 1959.

The treatment of monocular lesions of the optic nerve after severe cranial trauma has been controversial indeed. Two case histories are reviewed in detail which pertain to two patients, one with contusions of the brain and a pelvic fracture, the other with an injury to the supra-orbital arch. Both patients had a monocular disturbance of vision, with a dilated pupil which reacted only consensually to light. Retrobulbar injection of a 5-percent solution of sodium nicotinate resulted in considerable improvement of vision after eight and 20 days, respectively. The pupillary reflexes, however, did not return to normal. The author also reports a statistical review of the data on 63 accident victims seen at the Ophthalmic service at the Pitié; he discusses in succession the types of accidents, ages of the injured, concomitant injuries, visual disturbances, fields of vision, fundus changes, and radiologic and neurologic abnormalities. Several patients showed more or less pronounced spontaneous recovery. Medical treatment with vasodilating agents, either by infiltration of the sphenopalatine ganglion or simple retrobulbar injection, proved to be more successful and has been the method of choice by many authors. The scarcity of bone lesions and arachnoidal adhesions and the frequency of monocular retinal vascular disease favor the theory of a vascular origin of the optic nerve lesions. Very early treatment, even on unconscious patients, was suggested to combat successfully the dangerous post-traumatic vasoconstriction. (3 references) Alice R. Deutsch.

Stiefel, J. W. and Smith, J. L. **Hyaline bodies (drusen) of the optic nerve and**

intracranial tumor. A.M.A. Arch. Ophth. **65**:814-816, June, 1961.

This is the second reported case of a patient having drusen of the optic nerve and a proved intracranial tumor. A significant reduction in vision in association with such hyaline bodies requires careful neurologic evaluation. (1 figure, 8 references) Edward U. Murphy.

Sylvester, P. E. and Ari, K. **The size and growth of the human optic nerve.** J. Neurol., Neurosurg. & Psychiat. **24**:45-50, Feb., 1961.

A series of measurements of the optic nerves of 210 patients, ranging from infants to adults, showed an increase in the thickness of the nerve from birth to the age of four years. Minor growth may then continue until the age of eight years, after which virtually no growth occurs. (8 references, 3 figures, 2 tables)

Thomas H. F. Chalkley.

Yuri, Y., Komai, T. and Murai, M. **Electron microscopic research on secondary degeneration of the optic nerve of the mouse.** Jap. J. Ophth. **5**:47-57, April-June, 1961.

Electron microscopic observation was made on secondary degeneration of the optic nerve of the mouse with the use of prepolymer (polyester, epoxy resin) polymerization embedding. Findings obtained are as follows. Separation and fragmentation of the myelin sheath electron-microscopically demonstrated in the past are considered to be artifacts produced during the process of polymerization embedding. No production of artifacts was noted when the prepolymer preparation was used for polymerization embedding. A first sign of secondary optic degeneration appeared in endoplasmic reticuli in the axon cylinder 48 hours after the surgical procedure, and then mitochondria and axon filaments were affected. Large myelinated fibers were affected earlier than small ones. The internal structure of the axon cylinder fell into complete disintegration after five days. The lamellar structure of the myelin sheath was still well preserved 48 hours later. Six or seven days later the lamellar structure of the myelin sheath lost its distinctness and became obscured. The tips of flattened myelin sheaths were joined together and these sheaths formed a concentric ring. Ten or 15 days later this concentric ring turned into a large dense mass. After seven days glia cells showed a gradual tendency towards proliferation. (15 figures, 12 references) F. H. Haessler.

13

NEURO-OPHTHALMOLOGY

Ardonin, M., Carrot, E., Fevorier, V. M. and Catros, A. **The retinopathy of multiple sclerosis.** Bull. et mem. Soc. franç. d'opht. **72**:474-497, 1959.

The case histories of 60 patients with multiple sclerosis were reviewed. The diagnosis was substantiated by the typical clinical findings and verified by specific laboratory tests like the gold-sol reaction of the spinal fluid. The most pertinent data are summarized in statistical tables, which make time of onset, and somatic, neurologic, and ophthalmologic manifestations perspicuous. Ten case histories are reported in detail. Careful ophthalmologic and tonoscopic studies seem to justify the authors' opinion and seem to suggest the entity of a specific retinopathy of multiple sclerosis, which however appears in diverse forms. Changes of the disc, (78 percent) showed the classic, temporal palor, and diffuse pallor.) Changes of the arteries (41 percent) included increased relucency, an orange discoloration of the arterial walls (60 percent), and a mild elevation of the R.A.M. (50 percent). Venous abnormalities were of considerable interest. White sheathing was seen in 16 percent, pipe-stem sheathing in 16

percent, and fluffy nodules on the walls of the veins in 5 percent. Looping and tortuosities of the veins are also described, as well as occasional obliteration of the peripheral venous branches. Small chorioretinal lesions (20 percent) were discovered in the vicinity of veins, sometimes together with localized foci of retinitis proliferans. Small nodules in the depth of the vitreous apparently were connected with the veins by strands of organized blood. These characteristic vascular abnormalities speak in favor of a vascular or allergic etiology of multiple sclerosis and therefore are of great significance. The examination requires extreme care and patience. Polarized light ophthalmoscopy often provides clearer delineation. (24 references) Alice R. Deutsch.

Boncas, A. **Neurologic manifestations of Behçet's disease.** Bull. et mem. Soc. franç. d'opht. **72**:175-185, 1959.

The disease, described by Adamatiades and Behçet and carrying these two names, is a chronic disease. It enfolds insidiously and extends over many years. Signs and symptoms appear in various succession in different individuals. Mucocutaneous symptoms mostly precede the ocular disease. The involvement of the nervous system follows much later. Nervous abnormalities are only occasionally noted early or concomitantly with the eye disease. The prognosis always is serious as far as preservation of vision is concerned but it is benign as to life expectancy except in the presence of an affliction of the nervous system. In this case the prognosis always is grave. Poliomyelitis is the most serious complication, especially if it involves the brain stem. Other related neurologic syndromes are meningomyelitis and the confusional syndrome. This latter may follow an encephalitis. Case histories of three patients with Behçet's disease were discussed in detail; the patients did not only present the classical triad of the disease but also had severe involvement of the central nervous system which caused the death of two of the patients. Extreme prudence and caution is advised when using corticosteroids. The authors believe that the present name of this disease is not appropriate because of the rareness of the hypopyon. They suggest a change in nomenclature to "recurrent uveitis of young adults." (41 references) Alice R. Deutsch.

Bregeat, P., Juge, P. and Chareire, F. **Visual field anomalies in the course of persistent external ophthalmoplegia in adults.** Bull. et. mem. Soc. franç. d'opht. **72**:407-414, 1959.

Monocular disturbances in the visual fields have been described by various observers while studying visual and allied problems in all kinds of strabismus. The anomalies observed by the authors, however, have only been mentioned rarely. These are irregular but sharp restrictions in the peripheral and central fields which are always monocular. They are not caused by concomitant lesions in the optic pathways but can be ascribed to the dysfunction of the binocular vision. Functional visual disorders with impairment of visual acuity and field loss have a similar origin. In these cases amphetamine could reverse the trouble. Two case histories are reviewed and the corresponding defects in the visual fields are discussed in detail, stressing the particular instability in the perception of contrasts in luminosity and visual sensitivity as compared with the functional abolition by organic disease. All the tests were made with Goldmann's perimeter with pure white light. It was significant that the field of the other eye, under exactly the same working conditions, was entirely normal in both patients. (6 figures)

Alice R. Deutsch.

Collier, Michel. **Delayed epilepsy, semihypertrophic, follicular dyskeratosis of**

Darier, giant naevus of the eyebrow, and myelinated nerve fibers of the retina. Bull. et. mem. Soc. franç. d'opht. 72:530-537, 1959.

The association of myelinated nerve fibers of the retina, late epilepsy, dyskeratosis of Darier, and hemihypertrophy of the face in one person has not been described previously. The case of a 54-year-old woman is reported who had all the anomalies mentioned above. Her EEG (electro-encephalogram) showed disturbances of the theta and subdelta waves in the depth of the left temporal region. She also had early opacities of the lens. The skin lesion, predominantly in the cervical region and over the manubrium, appeared in childhood and progressed slowly. The family history was not contributory. Myelinated nerve fibers are frequently just an ocular anomaly. Simple, identical transmission is possible, or an unequal transmission in various forms, such as a coloboma of the optic nerve and persistence of the hyaloid system. This would be an expression of a mild local error or of a severe but still local malformation; occasionally it may be accompanied by remote anomalies, such as cranial deformations and neuro-ectodermal dysplasias. The polymorphism of these abnormalities is well known but the mechanism of the mesodermal participation in selected cases is not completely explained. (15 references, 4 figures) Alice R. Deutsch.

Desvignes, P., Bressman, N. and Larmeon, M. **Visual disturbances late after cranial trauma.** Bull. et. mem. Soc. franç. d'opht. 72:249-254, 1959.

Visual disturbances following cranial trauma are very difficult to evaluate. They present complex problems, especially from medico-legal viewpoints; and are often very hard to interpret. The history of a 19-year-old woman is discussed in detail to emphasize the intricacies of such situations. Severe visual disturbances occurred in the patient's left eye one month after an accident which caused temporary unconsciousness followed by severe headaches and nausea. After a short mucocutaneous disease the vision improved but small paracentral scotomata remained. Two months later the patient had a recurrence of her visual impairment. She showed small, right paracentral hemianopic scotomas and an inferior arciform scotoma in the left field. The fundi were normal. Small paracentral hemianopic scotomas often suggest an apical occipital lesion but may also be ascribed to isolated embarrassment of the optic pathways. This second relapse also subsided after a short time. No further follow-up examinations are reported.

The etiology of these successive visual disturbances remained unexplained. No compensation claims were involved in the case discussed but a functional cause should always be considered in similar cases. Injury to small vessels of the occipital pole or local inflammations in specific areas in the arachnoid of the occipital cortex or in the neighborhood of the optic nerve could be the anatomicopathologic basis for temporary visual failure of this kind. Alice R. Deutsch.

Guillamat, L., Petit-Dutaillis and Wiart, I. L. **Atypical semiology of pituitary adenomas. Prognosis.** Bull. et. mem. Soc. franç. d'opht. 72:399-406, 1959.

The pituitary adenoma still is a formidable disease in spite of the successes in hormone therapy and surgical techniques; the prognosis is even more serious if the usually very definite signs and symptoms are replaced by an entirely atypical symptomatology. The ophthalmologist, who frequently is the first to be consulted, should be aware of unusual perimetric defects, atypical ophthalmoscopic manifestations, and unfamiliar disturbances of motility and corneal sensi-

tivity. A number of relevant case histories are discussed in detail to put special emphasis on the relationship between these rare signs and pituitary tumors. Hemianopic scotomas are suspicious of a posterior extension of the tumors towards the pre-pontic region, while homonymous field defects point towards extension towards the pedunculi and affliction of the optic tracts. Another possibility is the invasion of the cavernous sinus, causing disturbances mostly of the third cranial nerve, occasionally the sixth nerve, and eventual intracranial hypertension and papilledema. In spite of the great surgical risks in pituitary tumors expanding towards the brain stem and the third ventricle, the situation varies from case to case because of the individual differences in the situations of the chiasma and the intracranial length of the optic nerve. Radio-tonography is of great diagnostic importance because it outlines the borders of the tumors, especially below, while arteriography gives additional information in outlining the vascular tree. The delay in early symptoms makes it very difficult to find a parallelism between the clinical development and eventual outcome in specific cases.

Alice R. Deutsch.

Leonardi, F. and Apollonio, A. **The retino-cephalic circulation in the Menière's and Menière-like syndromes.** Boll. d'ocul. **39**:722-740, Oct., 1960.

The authors found no alterations by means of ophthalmodynamometric studies, either in the retinal or arterial circulation in patients with either Menière's syndrome of Menière-like syndromes. They concluded that these syndromes were due to localized vascular disturbances in the labyrinth. (3 tables, 18 references)

Joseph E. Alfano.

Reinecke, R. D. **Migrainoid symptoms associated with intracranial vascular anomalies.** A.M.A. Arch. Ophth. **65**:808-810, June, 1961.

A patient is described who had a typical migraine aura but during an attack signs of subarachnoid bleeding and third cranial nerve palsy developed. Arteriograms showed two aneurysms of the cerebral vessels and a third was postulated. (4 figures, 6 references)

Edward U. Murphy.

Ricci, A. and Maeder, G. **Two cases of functional blindness with progressive recovery.** Bull. et mem. Soc. franç. d'opht. **72**:454-463, 1959.

Functional amaurosis is of rare occurrence. Only three cases have been admitted with this diagnosis at the ophthalmological service at Genève since 1943. Two of those cases are the topic of the present paper. The first patient was a 28-year-old man; the second patient was 35 years old. Both had been exposed to great mental strain, one during his military career and the other in difficult home surroundings. The first patient had recurrent episodes of blindness, the other exceeded him in time of recovery, which finally happened quite rapidly after incidental dental surgery. Diagnosis and treatment of this condition are equally difficult. It also is hard to differentiate between hysteria and deliberate simulations. During an hysterical attack, the afflicted person behaves like a blind person. Nevertheless a stimulation is carried to the visual center of the cortex, as shown by the presence of normal pupillary reaction, opto-kinetic nystagmus, and electro-encephalographic and retinographic tracings. It is often impossible to establish the episode and to exclude bilateral hemianopsia and incidents of migraine, eclampsia, and lead poisoning. Electroencephalography cannot be used in the differential diagnosis of hysteria and malingering because photic driving is present in both conditions, however definitely exaggerated in the for-

mer. Repeated testing is essential to exclude insidious organic lesions. Investigations on the possible curative effects of hypnotics have been started at various institutions. (13 references)

Alice R. Deutsch.

Richards, W. W. and Thompson, M. C. **Suprasellar osteochondroma with chiasmal syndrome.** A.M.A. Arch. Ophth. 65: 437-441, March, 1961.

This is an extremely rare type of intracranial tumor and in the case reported it caused bilateral optic atrophy with bitemporal field loss. The diagnosis was made from biopsy material. (6 figures, 12 references) Edward U. Murphy.

Saraux, H. and Martin, F. **The tonic pupil and Adie's syndrome.** Bull. et mem. Soc. franç. d'opht. 72:464-473, 1959.

The symptomatology of the tonic pupil has been well established, whereas its origin has remained obscure. The authors review the literature and discuss shortly 28 cases, all in adults; 75 percent were in women, a fact already mentioned in previous studies. The pupillotony of females is an autonomic syndrome, characterized by mydriasis, loss of the light reflex of one pupil, rarely of both, and pronounced tonicity of the accomodation-convergence reflexes. This abnormality is hereditary and probably recessive. There is also an acquired pupillotony, which more or less resembles the former, so that the differential diagnosis becomes difficult. Occasionally the etiology can be recognized (virus infections, syphilis, trauma). The localization of the lesion by means of pharmacologic tests with 2.5 percent mecholyl was mentioned during the discussion but apparently was not thought to be of great use by the authors themselves. (5 figures, 1 table, 39 references) Alice R. Deutsch.

Simon, K. A. **Conjugate downward gaze palsy following mumps encephalomyelitis.** A.M.A. Arch. Ophth. 65:789-791, June, 1961.

A case in a five-year-old boy is reported. Associated findings indicated a medial lesion involving the left uncrossed corticopontine gaze tract posterior to the oculomotor nuclei. (15 references)

Edward U. Murphy.

Thiebault, F., Matavulj, N. and Vrousos, C. **Visual field studies in the presence of temporal lobe lesions.** Bull. et. mem. Soc. franç. d'opht. 72:415-426, 1959.

Four case histories are reported in detail to emphasize the great diagnostic and topographic value of perimetry in the localization of temporal lobe lesions. Two cases were ascribed to accidents, and one to a temporal lobe abscess after mastoiditis. The fourth case, which was one of glioblastoma of the temporal lobe proved especially instructive because the visual fields were normal before surgery; after a resection of the growth from the depth of the anterior temporal lobe the patient developed a superior, mildly incongruent homonymous quadranopsia with preservation of the macula. Precise evaluations of visual fields are indicated in every case of post-traumatic epilepsy and this evaluation sometimes is more helpful in localization of focal lesions than ventriculography. After a deep amputation of the frontal lobe, a complete quadrantic defect is the result; all three isopters are involved, which means Meyer's loop has been resected in its entirety. In a superficial resection the peripheral field remains normal, whereas the central isopter shows the quadrantic defect, which is positive anatomic proof of the deep location of the peripheral and the superficial path of the central retinal extension fibers in Meyer's loop. The macular fibers follow a direct route to the occipital lobe. Lesions limited to an area of the parietal lobe cause an inferior lateral quadrantopsia. (4 figures) Alice R. Deutsch.

Viole, A. D. and Erdbrink, W. L. **Lid closure on mouth opening.** A.M.A. Arch. Ophth. **65**:798-800, June, 1961.

A case of inverted Marcus Gunn syndrome or Marin Amat syndrome is reported following meningitis with facial palsy. (1 figure, 11 references)

Edward U. Murphy.

14

EYEBALL, ORBIT, SINUSES

Böck, J. and Feyrter, F. **The benign epithelial tumors of the human orbit. I. The cylindroma.** Arch. f. Ophth. **163**:25-62, 1961.

The first 25 pages describe in detail the histopathological nature of cylindromas of mucous and salivary glands in the region of the head. Fourteen orbital cylindromas are shown to have similar features. (20 figures, 70 references)

Harri H. Markiewitz.

Böck, J. and Feyrter, F. **The benign epithelial tumors of the human orbit. II. The benign so-called mixed tumor.** Arch. f. Ophth. **163**:63-87, 1961.

The so-called mixed tumor of the salivary glands (as also the cylindroma) is a variety of the tubular-solid or solid adenoma. It is characterized by a myxomatous and chondromatous metaplasia of the tumor tissue. The description of mixed tumors in other regions of the head is followed by one of 22 similar orbital lesions. (15 figures, 22 references)

Harri H. Markiewitz.

Borley, W. E. and Miller, W. W. **Wegener's granulomatosis.** Tr. Am. Acad. Ophth. **65**:316-323, May-June, 1961.

This is the first case report in which orbital granuloma is presented and the eye symptoms were primary and persistent. It occurred in a 37-year-old man who first complained of pain, redness, and photophobia in one eye 20 months prior to enucleation and biopsy of the orbital mass. The patient died eleven days postoperatively and autopsy showed focal necrotizing arteritis of the heart, lungs, liver, kidneys, spleen, and adrenals. Glomerulonephritis, pancarditis, and granulomatous tumors of the lungs were found. The globe was seen to be six times normal thickness on the involved side. Marginal ulceration and infiltration of the cornea, uveitis, and inflammatory retinal detachment were noted. (8 figures, 7 references)

Harry Horwich.

Conklin, W. H., McClintlock, J. C., Baxter, D. H. and Peck, F. C., Jr. **Management of exophthalmos.** Am. Surgeon **26**:582-587, Sept., 1960.

Severe exophthalmos in thyrotoxicosis may cause marked visual loss due to corneal ulceration and infection, or direct compression of the optic nerve. Anterior pituitary dissection seems to offer the most promising results for the arrest of this condition. However, as preliminary measures, ablation of the thyroid gland by radioactive iodine or decompression of the orbit may enable many patients to avoid pituitary surgery. (2 tables, 41 references)

Thomas H. F. Chalkley.

Falconer, Murray A. **The managment of hormonal exophthalmos. The role of surgical decompression.** Tr. Ophth. Soc. U. Kingdom **80**:87-105, 1960.

If and when hormonal exophthalmos has progressed to the stage in which corneal ulceration has appeared or is imminent, or papilledema is so marked that vision is failing, some form of orbital decompression is indicated. Various routes can be used.

Eleven cases of hormonal exophthalmos which is self-limiting are tabulated with the end results. Operation may be required to prevent corneal ulceration and the loss of the eye. The operation is not a specific therapy, it merely enlarges the

orbit to accommodate the swollen orbital tissues. Appropriate operation on the extrinsic ocular muscles may be necessary. (15 figures) Beulah Cushman.

Lijo Pavia, J., Pianciola, A. and Ratto, R. **Phlebitis of the angular vein.** Rev. otoneuro-oftal. Sudam: **36**:16-19, Jan.-March, 1961.

The authors present the case history of a child who had a furuncle on the left upper lip, which dissappeared almost completely without any treatment when he developed a very severe cellulitis of the left orbit with acute tenderness and induration along the entire palpable course of the angular vein. The inflammation subsided with systemic antibiotics. The authors then discuss the change in prognosis which has occurred in this type of infections since the discovery of the antibiotics. Walter Mayer.

Lister, John. **The management of hormonal exophthalmos.** Tr. Ophth. Soc. U. Kingdom **80**:67-74, 1960.

The precise cause of the eye signs in Graves' disease has not been fully established but is associated with thyroid activity, increased orbital content, and an anterior pituitary influence. Treatment consists of careful clinical assessment of thyroid function and treatment of the hyperthyroid or hypothyroid state, diuretic therapy, and depression of the pituitary function. Steroid therapy and pituitary extirpation or irradiation have brought about improvement in certain cases. Local surgical treatment remains as the essential method of protecting the cornea and visual function.

Beulah Cushman.

Lyle, T. Keith. **The management of hormonal exophthalmos.** Tr. Opth. Soc. U. Kingdom **80**:107-130, 1960.

The author discusses the treatment of strabismus associated with hormonal exophthalmos. Frequently a differential diagnosis is necessary between orbital tumor and myasthenia gravis. Recurrent attacks of diplopia are often due to a palsy of the inferior rectus muscle and develop rapidly. The aim of treatment is to restore equal and symmetrical ocular movement in all directions of ocular gaze.

The author reports that the interval of time between the onset of diplopia and the surgical treatment has varied from six months to 19 years, the average being four years at the time the ocular condition has become static. The average case of hormonal exophthalmos seems to run a course of about six months to a year. (4 figures, 2 tables) Beulah Cushman.

Lyle, T. K. **Displacement of the orbital floor and traumatic diplopia.** Brit. J. Ophth. **45**:341-357, May, 1961.

Most frequently diplopia resulting from trauma is due to direct trauma to an extrinsic ocular muscle but at times it may be due to trauma to the orbit. This trauma results in displacement of one eyeball interrupting the alignment of the visual axis with resultant vertical diplopia. It is quite possible to have gross displacement of the eyeball with no displacement of the visual axis and there may also be slight anatomic displacement with much resultant diplopia as a result of it. Repair of the bony disfigurement must be accomplished as soon as the shock of the trauma is past and should be done within three months.

A series of 18 cases and their surgical repair is described in some detail. The results of treatment by surgery of one or more extrinsic ocular muscles were uniformly good with restoration of normal ocular alignment and binocular single vision. (14 figures, 4 tables, 10 references)

Morris Kaplan.

Renard, G. and Dhermy, P. **Intraocular penetration of a sinus epithelioma follow-**

ing orbital invasion. Bull. et mem. Soc. franç. d'opht. **72**:158-167, 1959.

Intraocular penetration of an orbital tumor is indeed a very rare event, with the exception of perilimbal and conjunctival epitheliomas, whose intraocular invasion has been observed occasionally. The case history under discussion revealed that the patient had been operated on previously for a right frontal sinusitis. A complete ptosis followed this operation. Exotropia, chemosis, and a proliferation in the internal lid angle occurred in close succession. A biopsy of the subconjunctival growth disclosed epidermoid epithelioma with areas of parakeratosis. The eye became blind. It was decided to exenterate the orbit to relieve the patient of his agonizing pain. The orbital floor was found to be intact. It was assumed at this time that the tumor had penetrated into the orbit through the ethmoids and their delicate walls. Serial sections through the globe showed a twofold, completely separated invasion route, one anteriorly through the collector channels, the other posteriorly in the area of a muscle insertion.

The patient did not return for follow-up examination. (27 references)

Alice R. Deutsch.

Roth, A., Kogan, P. and Brini, A. **Eosinophilic granuloma of the orbit.** Ann. d'ocul. **194**:481-491, June, 1961.

Eosinophilic granulomas of the orbit occur primarily in young individuals, and usually present themselves as a palpebral mass in the orbit associated with some inflammatory signs. Characteristically there is evidence of bony erosion by X-ray and accompanying eosinophilia of the blood.

The authors report just such a case in an eight-year-old girl where the tumor was removed surgically and the diagnosis confirmed by histologic examination. They discuss the possible etiologies of this tumor and state that the majority of authors today consider this as part of a group of diseases including Schüller-Christian disease and Letterer-Siwe disease. They suggest that the eosinophilic granuloma represents the localized form of the disease, that the Letterer-Siwe syndrome represents the acute disseminated form, and that the Schüller-Christian syndrome represents the chronic disseminated form. (2 figures, 25 references)

David Shoch.

Stallard, H. B. **The management of hormonal exophthalmos.** Tr. Ophth. Soc. U. Kingdom **80**:75-85, 1960.

Surgical means are necessary 1. to protect the cornea until natural regression of the exophthalmos occurs to the extent that the upper lid completely covers the cornea on gentle closure of the eyelids and 2. to relieve the damaging effects of the intraorbital traction and compression of the optic nerve and eyeball and, much later, to correct the muscle imbalance. The author discusses the surgical treatment of the patient. He emphasizes the different steps necessary in protecting the cornea by means of conjunctival flaps, fasciotomies, and tarsorrhaphies, and the use of diamox and miotics for complicating glaucoma. Naffziger's operation is indicated when the orbital pressure is so raised that vision is lowered from papilledema and compression of the optic nerve. Decompression of the lateral wall is indicated when there is orbital pulsation. (9 figures) Beulah Cushman.

Vancea, P., Triandaf, E. and Gavrilita, L. **Angio-reticuloma of the orbit.** Ophthalmologica **141**:245-252, March, 1961.

Because of its rarity and some unusual features, a clinical case report is presented and the subsequent histological findings are described. A rapidly growing tumor causing marked proptosis was treated by

orbital exenteration. No follow-up is reported. (3 figures, 14 references)

Lawrence T. Post, Jr.

15
EYELIDS, LACRIMAL APPARATUS

Blatz, G. **The relation of lacrimal secretion to chronic rheumatism.** Arch. f. Ophth. **163**:389-396, 1961.

The lacrimal secretion, measured by means of the Schirmer test in over 300 patients with known rheumatism, was compared with that of normal individuals. No outstanding differences were noted and extremely diminished secretion was exceptional, so that Sjögren's syndrome is apparently not related to typical chronic rheumatism. (5 figures, 3 tables, 19 references) Harri H. Markiewitz.

Gregg, F. H. and Green, D. **Abnormal associated lid movements following seventh nerve paresis.** A.M.A. Arch. Ophth. **66**:112-115, July, 1961.

A case is reported which was characterized by lid closure on opening the mouth. There was no history of a preceding peripheral seventh-nerve palsy but the patient apparently had recurrent brain stem infarction. The literature is reviewed. (4 figures, 7 references)

Edward U. Murphy.

Hassmann, W. and Omulecka, D. **External and internal nasolacrimal anastomosis.** Klinika Oczna **31**:35-39, 1961.

The authors discuss the literature on dacryocystorhinostomy and conclude that the results are about the same regardless of the type of operation. The intranasal approach, however, usually requires an experienced otolaryngologist, whereas the external dacryocystorhinostomy can be done by an ophthalmologist early in his career. In the clinics of the authors 146 operations were performed in the course of the six-year period of which 105 were external and 41 intranasal. Good results were obtained in 88 to 90 percent of cases in both types of operation. The advantage of the external type permitted all members of the eye clinic to do this operation. The intranasal type was done only by one surgeon. (29 references)

Sylvan Brandon.

Jones L. T. **An anatomical approach to problems of the eyelids and lacrimal apparatus.** A.M.A. Arch. Ophth. **66**:136-150, July, 1961.

The anatomy is described and illustrated in detail and several surgical procedures for improving function in this area are discussed. (26 figures, 13 references) Edward U. Murphy.

Marconcini, E. **A case of primary endothelioma of the eyelid.** Arch. di ottal. **64**: 251-260, July-Aug., 1960.

This is a review and a case report of the lesion in a child aged 14 years. (5 figures, 23 references) Paul W. Miles.

Ostachowicz, M. and Masiak, M. **Treatment of lid margins by linomag.** Klinika Oczna **31**:31-34, 1961.

The author treated patients with chronic recurrent blepharitis with medicines containing unsaturated fats and linolic and linolenic acids. They were applied locally and taken internally . In 53 of 82 cases improvement appeared after the first course of treatment and in an additional 12 cases after a second course. The authors feel that the drug has a regenerating influence on the epithelium. (3 table, 6 references) Sylvan Brandon.

Pang, H. G. **Surgical formation of upper lid fold.** A.M.A. Arch. Ophth. **65**:783-784, June, 1961.

A simple technique not requiring a skin incision is described. This is the method used in the Far East as an office procedure. (1 figure) Edward U. Murphy.

Pierce, Dermot. **Excision and repair of eyelid tumors.** Tr. Ophth. Soc. U. Kingdom **80**:39-49, 1960.

The author discusses 31 cases of lid tumor; 24 were diagnosed as rodent ulcers, 17 of which were post-operatively called basal cell carcinoma; three squamous cell epithelioma, three tricho-epithelioma, and one benign adenoma. Adequate excision with a margin of healthy skin and conjunctiva is indicated and the excision must be sufficient in depth. Repair was carried out by making a sliding flap from the lateral side or a rotation flap from the upper lid. Biopsy excision makes radio therapy possible if the tumor proves to be malignant. (6 figures)

Beulah Cushman.

Segal, P. and Jablonska, S. **The syndrome of Ascher.** Ann. d'ocul. **194**:511-526, June, 1961.

The syndrome of Ascher is a combination of a blepharochalasis associated with an edema of the lips, giving rise to the so-called "double lip," and an associated goiter without any sign of hyperthyroidism. The authors describe a case in which there was atrophy of one lid, and edema of the other. They feel that the edema is a transient stage between a normal lid and the atrophic one. No hormonal disturbances were revealed and histopathologic examination of the eyelid showed only atrophy of the epidermis and cutis, and a pronounced destruction of the elastic fibers. The authors conclude that the syndrome is probably caused by an endocrine dysfunction. (6 figures, 33 references)

David Shoch.

Sigelman, S. C. and Muller, Paul. **Primary tuberculosis of the lacrimal sac.** A.M.A. Arch. Ophth. **65**:450-452, March, 1961.

A case of dacryocystitis is reported in which no other tuberculous lesion could be demonstrated. Clinically the infection seemed non-specific but cultures following dacryocystectomy showed acid-fast bacilli. (9 references)

Edward U. Murphy.

Valière-Vialeix, V., Robin, A. and Chaput, M. S. **The surgical treatment of canalicular obliterations of the lacrimal passages particularly by "lacodacryostomy."** Ann. d'ocul. **194**:97-122, Feb., 1961.

The history of the treament of canalicular obstructions is given and a discussion of the three general types of obstruction follows. These types are congenital, inflammatory, and traumatic. After defining the three types of obstructions the authors state that one method of treatment suffices to treat all three types. They first review the various treatments. First, the placing of a thread of silk or catgut or metal in the canaliculus to restore its patency; secondly, a skin or mucous membrane graft, and finally, a "lacodacryostomy." The latter is the method that the authors prefer and which they have used in a series of 19 cases which they report here.

One may approach the canaliculi through the conjunctiva of the lids, or through the skin overlying the lacrimal sac. The authors prefer the former and give a detailed outline of the technique involved. In essence, both superior and inferior canaliculi are slit open and the conjunctiva medial to this area dissected free. This conjunctiva is sutured through the posterior lip of the lacrimal sac wall. In those cases where there is also an obstruction of the naso-lacrimal canal a dacryocystorhinostomy is also performed. (2 figures, 2 tables, 10 references)

David Shoch.

Valiere-Vialeix, V., Robin, A. and Chaput, C. **Canalicular obliterations: etiology, diagnosis and treatment.** Ann. d'ocul. **194**: 259-271, March, 1961.

Obstruction of the lacrimal canaliculi may be the result of any of six causes. These are congenital obliteration, and obliteration by calculi and foreign bodies, and obliteration by tumor, trauma obliteration and infection. The authors discuss each of these possible etiologies. The second portion of the article deals with the diagnosis of these obliterations, and the authors discuss the use of injection of the lacrimal passageways and catheterization of these tracts. The final section deals with the treatment of canalicular obstructions, but omits discussion of specific surgical procedures since this was covered in an article in the preceding issue of the journal. (12 references)

David Shoch.

Vergez, A. **Contribution to the diagnosis and non-operative treatment of disease of the lacrimal tract.** Ann. d'ocul. 194:193-216, March, 1961.

The author reviews the various methods for investigation of the patency of the lacrimal tract. He then offers a method which he feels is superior to those in use today. He uses an ointment of calomel in vaseline and lanolin. This is a 40-percent calomel ointment and is radio-opaque. In addition to providing good radiographs, the ointment also acts as a mechanical force to break down small adhesions in the lacrimal tract. In the course of 68 such procedures, only two complications have occurred.

Where indicated the use of this ointment may be followed by that of appropriate antibiotic solutions. An additional advantage of this method is that the ointment serves as a marker to outline the lacrimal sac and canal in surgical procedures. (11 figures, 16 references)

David Shoch.

16

TUMORS

Cherington, F. J. **Metastatic adenocarcinoma of the optic nervehead and adjacent retina.** Brit. J. Ophth. 45:227-230, March, 1961.

Metastatic tumors of the optic nerve and its sheaths are very rare but of these the most common is adenocarcinoma from the breast or the pancreas. Cherington briefly describes a case of a pedunculated metastatic adenocarcinoma of the optic disc which came from the lung. Histologic examination of the enucleated eye also revealed some involvement of the adjacent retina. (3 figures, 6 references)

Morris Kaplan.

Freeman, R. G., Cloud, T. M. and Knox, J. M. **Keratoacanthoma of the conjunctiva.** A.M.A. Arch. Ophth. 65:817-819, June, 1961.

This is a benign epithelial tumor which develops rapidly over several weeks and regresses within a few months. The usual location is the skin and this is the first reported case of this lesion in the conjunctiva. It may be confused with a squamous cell carcinoma. (2 figures, 12 references) Edward U. Murphy.

Hobbs, H. E. **Haemangioma of the orbit. Report of a case.** Brit. J. Ophth. 45: 231-235, March, 1961.

Haemangiomata may be classified as benign tumors in the orbit which may exert pressure upon the orbital contents. This pressure may result in proptosis with exposure keratitis or corneal ulceration or optic atrophy due to pressure directly on the optic nerve. Hobbs reports a case in a 48-year-old man who complained of diminishing vision in one eye and who had been treated by means of glasses and orthoptics for three years. The amblyopia continued to progress until ocular displacement and severe astigmatism ensued. Angiograms and phlebograms were negative, but surgical removal of a suspected orbital tumor was carried out. The tumor was found to be a sclerosing angioma. Postoperative recovery of vision was complete. (5 figures, 7 references) Morris Kaplan.

Mortada, A. **Orbital reticulum-cell sarcoma. Report of nine cases.** Brit. J. Ophth. **45**:365-36, May, 1961.

There is much confusion in the nomenclature and classification of lymph cell tumors; the group of lymphomatous tumors includes reticulum-cell sarcoma, leukemia, Hodgkin's disease, follicular lymphoblastoma, lymphosarcoma, and lymphoma. The histologic picture is not always clear but reticulum-cell sarcoma does present large pleomorphic cells with vesicular nuclei and argentophile reticular fibers. Of 100 orbital tumors removed surgically, nine were proved to be this tumor by histologic study. These nine patients and the tumors which had been removed surgically are described briefly. The ages of these patients varied from four to 64 years. (18 figures, 1 table, 27 references) Morris Kaplan.

17
INJURIES

Dollfuss, M. A., Guillaume, I. M. and Lebouc-Vigier. **Fundus changes due to recent cranial trauma. Review of 500 cases.** Bull. et. mem. Soc. franç. d'opht. 427-434, 1959.

The interpretation of ocular signs and symptoms and their evaluation in reference to hematoma of the meninges or brain substance has met with considerable difficulty. The patients examined by the authors were seen either 24 or 48 hours after the accident, often still unconscious, or they were seen in consultation 14 to 30 days after the initial trauma.

Fundus changes during the first 48 hours were rare; papilledema occurred in about 20 percent of the cases, and was apparently independent of simultaneous coma or fracture. Papilledema, especially accompanied by intra- or preretinal hemorrhages, definitely was considered to speak for the presence of cerebral hematoma, as does the papilledema which developed gradually in an initially normal nervehead. Examinations of the ocular motility and tracings of visual fields were found to be even more difficult to make. Among the patients examined, 36 had paralysis of the external eye muscles, nine had homonymous hemianopsia, and three bilateral hemianopsia. The importance of the size and reactivity of the pupils has been recognized for a long time, not only by the ophthalmologists but also by the surgeon and neurologist. A series of pertinent case histories is included.

Alice R. Deutsch.

Kittel, B. **Eye injuries caused by minute metallic fragments.** Klin. Monatsbl. f. Augenh. **138**:246-255, 1961.

Minute foreign bodies frequently escape X-ray diagnosis. Gonioscopy, careful slit-lamp examination of the limbal vessels, and inspection of the anterior segment are essential, particularly in injuries caused by explosives. Dark adaptation tests and ERG are valuable additional methods in following such patients. Three cases are reported. (8 figures, 16 references) Gunter K. von Noorden.

Malecka, Alicja. **Analysis of eye injuries on the basis of material of the S.M.A. Eye Clinic in 1952-1956.** Klinika Oczna **31**:71-82, 1961.

The author presents statistics from an eye service located in a coal-producing area. Injuries represented 27.3 percent of the clinical material. Among the injured, men were 82.1 percent, women 7.6 percent and children 10.26 percent. The percentage of children is rather small by comparison with statistics from other areas of Poland. The author emphasizes the fact that 53.65 percent of injuries were in the coal miners and only 15.3 percent were in metal workers. Agricultural workers represented only 3.37 percent of injuries. Because of the character of industry, particles of stone and coal were the most frequent causes of the injuries, metal particles followed, then

burns and contusions. Loss of eyes or loss of useful vision was 21.7 percent in adults and 19.2 percent in children. (13 tables, 12 references) Sylvan Brandon.

Majima, Akio. **Eye abnormalities in mice embryos caused by X-radiation of mothers.—On changes in the initial stage of development by irradiation on the eighth day of pregnancy.** Jap. J. Ophth. 5:28-38, April-June, 1961.

Mice were subjected to a single whole body X-radiation of 150r, 100r, 50r, and 25r respectively on the eighth day of pregnancy. The embryo was observed in gross and microscopic examinations on the thirteenth embryonic day. Microscopic findings are emphasized. Gross eye abnormalities were found in approximately 25 percent of the group treated with 150r, 8 percent in that treated with 100r, less than 1 percent in that treated with 50r, and none in that treated with 25r. All these eye abnormalities were an- or microphthalmias.

In most of the embryos in which development was retared, development of the eye was also exceedingly retarded. Among eye abnormalities of high degree, there were no cases ascribed to the primary anophthalmia, and a vestigal optic cup was evident under the microscope in every case of anophthalmia.

In hydrocephalic members the lumen of the optic stalk was enlarged and the optic cup was also malformed in almost all cases. The shape of the eye seemed apt to become long and thin in the direction of the axis of the optic cup. In some of them the optic stalk was so short that the optic cup did not reach the subepidermal region and the lens was also absent. (8 figures, 2 tables, 10 references)

F. H. Haessler.

Szabo, G. **A new operative procedure for removal of nonmagnetic foreign bodies penetrating the cornea.** Klin. Monatsbl. f. Augenh. 138:236-246, 1961.

The removal of foreign bodies which penetrate the cornea and extend into the anterior chamber frequently presents great difficulties. Various methods are mentioned. The author uses an eye dropper connected by a rubber tube with a syringe. The tip of the dropper is placed on the cornea over the foreign body, and negative pressure is applied with the syringe. Aqueous humor is aspirated and rinses the foreign body out. (4 figures)

Gunter K. von Noorden.

18

SYSTEMIC DISEASE AND PARASITES

De Andrade, L. **Ophthalmology and its relationship to the healthy and sick human being.** Arq. Portug. Oftal. 12:13-31, 1960.

The author reviews very briefly the relationship between ophthalmology and general medicine in relation to headache, ocular hypertension, arterial hypertension, tuberculosis, syphilis, allergic disease, and metabolic and neurologic entities. He emphasizes the economic significance of eye diseases and disabilities and calls attention to some peculiar eye findings in some of the masterpieces of the classical painting. (11 figures)

Walter Mayer.

De Faria, D. **Ocular manifestations of onchocercosis.** Arq. Portug. Oftal. 12: 103-110, 1960.

The author studied 200 cases of onchocercosis (infection with a filarial worm) and found a much greater incidence of blindness directly attributable to this disease than had been expected previously. The most severe of the eye manifestations of onchocercosis is an optic neuritis which is followed by optic atrophy with or without an associated chorioretinitis and iritis. The author also found nodules in the conjunctiva, pigmentary changes at the limbus, nodules on the iris, and microfilaria in the transparent media of the eye. Walter Mayer.

Jaworowska, H. and Rogala, H. **Aortic arch syndrome.** Klinika Oczna **31**:11-16, 1961.

A case of aortic arch syndrome is presented in a man, 59 years of age. Symptoms consisted of momentary fogging of vision, dizziness, and short-lasting blackouts following sudden movement or effort. Cigarettes and alcohol aggravated the symptoms. The intensity of symptoms gradually increased. The right eye was degenerated as a result of previous injury. The pupil of the left eye was dilated and fixed; the arteries of the retina were narrow, the veins were distended, and there were many microaneurisms and hemorrhages. Definite insufficiency of the arterial circulation of both upper extremities and of the left common carotid artery was found. Treatment with anticoagulants was temporarily beneficial. The authors discuss the aortic arch syndrome and present the views of many authorities on the subject. (17 references)

Sylvan Brandon.

Krych, Josef. **Ocular symptoms of Steinert's disease (dystrophia myotonica).** Klinika Oczna **31**:17-26, 1961.

The author states that myotonic dystrophy presents the following groups of symptoms: 1. atrophy of some muscles, 2. myotonia, 3. glandular disturbance particularly affecting the sexual glands, 4. some developmental changes, and 5. eye symptoms. The latter consist of ptosis, ectropion of the lower lids, some muscle imbalance, and occasional changes in the cornea and iris. The most frequent ocular change is the formation of cataracts. Changes in the pigmentation of the retina are also found. The author discusses the pathology and the etiology of changes in the myotonic dystrophy; he also presents myotonic cases of his own in four young men. His conclusions are that the disease is relatively frequent but often not recognized. Cataracts are frequent but are not seen in all cases. Changes in the retina require further studies and elucidation. (2 figures, 12 references)

Sylvan Brandon.

Lapa, S. **Ocular onchocercosis.** Arq. Portug. Ofal. **12**:51-73, 1960.

The author studied 100 natives of Angola who had been diagnosed as having onchocercosis on the basis of eye findings they may have had. He found among them acute catarrhal conjunctivitis, a dispersion of pigment at the limbus, keratitis, iritis and iridocyclitis. At the posterior pole he found examples of hyperemic discs, primary and secondary optic neuritis, as well as retrobulbar neuritis. He then outlines his system of treatment with Hetrazan and Moranyl and advocates the surgical excission of nodules and cysts spread over the body. (14 figures, 15 references) Walter Mayer.

Lasco, F. and Nicolesco, M. **Ophthalmic localizations of the collagen diseases.** Arch. d'opht. **20**:602-615, Sept., 1960.

The authors note that the ocular manifestations of the collagen diseases have diagnostic importance and in addition give valuable prognostic information. In certain of these diseases, such as periarteritis nodosa and temporal arteritis, eye changes are a part of the disease, while in others, such as dermatomyositis and lupus erythematosus, eye changes are late or absent. The authors proceed to summarize the ocular signs in the various conditions, citing case reports to illustrate the salient features. The report is illustrated with fundus drawings and photomicrographs of the described lesions. Particular attention is given to periarteritis nodosa and to temporal arteritis, but other conditions discussed include lupus erythematosus, serum sickness, dermatomyositis, and diffuse scleroderma. A good bibliography is appended. (4 figures, 75 references) P. Thygeson.

Lerman, Sidney, and Feldman, A. L. **Centrocecal scotomata as the presenting sign in pernicious anemia.** A.M.A. Arch. Ophth. 65:381-385, March, 1961.

Pernicious anemia can first manifest itself as a progressive loss of vision without other neurologic findings. A patient is described in whom this sign led to the diagnosis and rapid visual improvement followed vitamin B_{12} therapy. (4 figures. 10 references) Edward U. Murphy.

Lo Cascio, G., Jr. **Two cases of spontaneous healing of carotid-cavernous sinus fistula.** Arch. di ottal. 64:197-208, July-Aug., 1960.

The author reviews the symptoms and signs of carotid-cavernous fistula and presents two cases. Both patients were over 60 years of age and had typical symptoms; both gave a history of facial paralysis on the same side three years or more before. In the first patient arteriography revealed a saccular aneurysm near the sella. Spontaneous recovery was attributed to phlebothrombosis of the cavernous sinus.

The second patient had a cataract and trigeminal neuralgia on the same side. The eye symptoms and signs disappeared, but a bruit persisted. The orbital pressure was evidently relieved by a thrombosis of deep orbital veins. (2 X rays, 22 references) Paul W. Miles.

Manschot, W. A. **The eye in relation to collagen disease.** Tr. Ophth. Soc. U. Kingdom 80:137-151, 1960.

In 1942 Klemperer, Pollack and Baehr first used the term diffuse collagen disease in clinical medicine and applied the term originally to a group of maladies characterized morphologically by systemic alterations of the intermediate substances of the connective tissue, the collagen fibers. They referred to the complete intercellular connective tissue substances, both fibers and ground substance.

Connective tissue consists of an interlacing network of collagen, reticulin and elastic fibers lying in a nonfibrillary matrix of ground substance, scattered through the tissue and a variety of isolated cells. The ground substance consists of tissue fluid derived from blood plasma, and has a high content of mucopolysaccharides and glycoproteins. The mucopolysaccharides are divided into two groups on the basis of the presence or absence of sulphate. In some tissues, such as the vitreous, only the non-sulphated polysaccharides are present. The sulphated polysaccharides apparently form the cemet substance within collagen and cartilage. The principal fibrillary component of connective tissue is formed by collagen, which develops extra-cellularly under the influence of fibroblastic activity.

Normal connective tissue contains fibroblasts, lymphocytes, plasma cells, mast cells and perhaps histiocytes and neutrophil leucocytes, the most important cellular constituents being fibroblasts and mast cells.

The fundamental pathologic process in connective tissue consists of degeneration and proliferation, with a secondary inflammatory reaction. Scleral lesions are scleromalacia perforans, necrosing nodular scleritis, massive granuloma of the sclera, and annular and brawny scleritis. Uveal involvement in collagen diseases is limited to rheumatoid arthritis and periarteritis nodosa. Retinal changes occur in periarteritis nodosa, temporal arteritis and disseminated lupus erythematosis and dermotomyositis. Lesions of the optic nerve occur either by occulsive vascular changes or as a secondary manifestation of a toxic neuro-retinopathy or increased intracranial pressure. (9 figures) Beulah Cushman.

Marquardt, R. **Eye changes in malignant lymphogranulomatosis (Hodgkin's disease).** Klin. Monatsbl. f. Augenh. 138: 535-549, 1961.

The literature on ocular manifestations of Hodgkin's disease is reviewed. The case of a 22-year-old man is reported who developed chorioretinitis and iridocyclitis in both eyes prior to his death from lymphogranulomatosis. The histologic findings are demonstrated and discussed. (6 figures, 34 references)

Gunter K. von Noorden.

Mettier, S. R., Jr. **Ocular defects associated with familial renal disease and deafness.** A.M.A. Arch. Ophth. **65**:386-391, March, 1961.

Two cases of familial nephritis associated with deafness and anterior lenticonus are reported. This is the first report in the ophthalmic literature of ocular complications in this syndrome. (2 figures, 2 charts, 33 references)

Edward U. Murphy.

Mühler, E. **Sjögren-syndrome and periarteritis nodosa.** Münchner M. Wchnschr. **103**:504-506, March, 10, 1961.

The Sjögren syndrome and periarteritis nodosa probably have a common pathogenesis. Chronic polyarteritis generally occurs before the Sjögren syndrome becomes apparent in those cases in which they occur together. (34 references)

Thomas H. F. Chalkley.

Segal, P., Adamczewska, Z. and Krawczwk, Z. **Some ocular symptoms of thrombosis of the internal carotid artery.** Klinika Oczna **31**:1-9, 1961.

A case of one-sided thrombosis of an internal carotid artery is presented. General hypertension, arteriosclerosis, and obliterating arteritis were present. In the eye there were cotton-wool patches and low blood pressure of the central retinal artery. Changes in the number of exudates paralleled closely the variations of the retinal blood pressure. The authors discuss the mechanism of formation of cotton-wool exudates and suggest that they appear in the areas of impaired metabolism with poor circulation. The basic causes, arteriolar spasm or low arterial pressure, apparently produce the same changes. (4 figures, 29 references)

Sylvan Brandon.

Woillez, M., Asseman, R. and Lekieffre, M. **Unusual complications of temporal arteritis.** Bull. et mem. Soc. franç. d'opht. **72**:658-668, 1959.

Two case histories, one of a 77-year-old man, the other of a 58-year-old man are discussed in detail to demonstrate certain clinical and ophthalmoscopic peculiarities of temporal arteritis. The classical signs of this disease, namely edema, exudates, and hemorrhages, are not only characterized by their clinical appearance but also by the suddenness of their development. They are ascribed to a blocking of the vascular branches due to infiltration of the arteriolar walls by a granulation tissue which is rich in giant cells. The first patient reported had typical changes in the first eye, but had atypical field changes in the second eye caused by an optic neuritis. The second patient showed dysorique nodules (Rothspots) unusual in temporal arteritis and in themselves unspecific characteristics of a diffuse damage to the endothelium, and of an affliction of the "membrane hematotissulaire." The confrontation and comparison between endotheliosis and collagenosis is not new and has been studied in various collagen diseases. In spite of individual anatomic and clinical research, the concepts of the pathogenesis of temporal arteritis are, at least partly, still hypothetical. (6 figures) Alice R. Deutsch.

19
CONGENITAL DEFORMITIES, HEREDITY

Drenckhahn, F. O. and Behnke, H. **The variability of the clinical manifestation of iris defects in two families with hereditary aniridia.** Klin. Monatsbl. f. Augenh. **138**:545-557, 1961.

Complete and partial aniridia, colobomatous iris defects, aplasias and hypoplasias of the stroma were found in two families. The hereditary pattern was autosomal dominant. Some eyes were suspected of having a foveal aplasia in addition to aniridia. Nystagmus occurred frequently in members of these families. (9 figures, 2 tables, 36 references)

Gunter K. von Noorden.

Levy, J. and Anderson, P. E. **Marchesani's syndrome.** Brit. J. Ophth. **45**:223-226, March, 1961.

Marchesani's syndrome is a congenital abnormality with skeletal and ocular abnormalities. The body changes seem almost opposite to those of Marfan's syndrome in that the stature is short, stocky and well-developed, the skin and hair thick and the hands spade-like with short, stubby fingers. The ocular abnormalities are spherophakia and ectopia lentis resulting in myopia and iridodonesis with severe glaucoma which responds very poorly to all treatment. The condition is familial. A 16-year-old boy is described who presented all the typical signs and symptoms with the exception that the glaucoma of one eye responded to an iridectomy ab externo. (1 figure, 14 references) Morris Kaplan.

Paganoni, C. **Gonioscopic observations in a case of mesodermal dysgenesis of the cornea and iris.** Arch. di ottal. **64**:221-228, July-Aug., 1960.

A case of angle dysgenesis accompanied by embryotoxon posterior, iris coloboma, and glaucoma is presented. The author discusses whether the tissue in the angle was the result of failure of embryonic splitting or of a more complex anomalous process. (3 figures, 10 references) Paul W. Miles.

Pitt, D. B. **Congenital malformations and maternal rubella: progress report.** Med. J. Aust. **1**:881-890, 1961.

An interim report is presented of a prospective series of 145 cases of rubella in pregnancy in Australia observed during the years 1956 to 1959. A detailed account of clinical features and investigations is given to confirm the diagnosis of rubella. Of the pregnancies in which rubella occurred in the first trimester 61 children have been examined by pediatricians; 13 (21.4 percent) of these children have some damage attributed to rubella. The number of cases for the first four weeks of pregnancy is very small but it is considered that the risk in this period rises to 52.8 percent. Few eye defects were found, only two of which were severe and fortunately they were unilateral. The more serious complications found in previous retrospective series receive no comment. An editorial is printed on pages 901 to 903 of the same journal. (13 tables) Ronald Lowe.

Srivastava, S. P. **Microcornea and congenital coloboma of iris and choroid in one eye with congenital glaucoma and corneal opacity in the other eye.** Brit. J. Ophth. **45**:382-383, May, 1961.

A newborn female baby had unilateral buphthalmos with complete corneal opacity and elevated tension; the second eye had microcornea with coloboma of the iris and choroid. It is most unusual to find these unrelated anomalies in one individual. (1 figure) Morris Kaplan.

Vancea, P., Barbu, G., Vancea, P. P. and Cernea, P. **The eye and cranio-facial dysostosis.** Arch. f. Ophth. **163**:358-375, 1961.

The authors describe five patients afflicted respectively with hemicrania, Crouzon's type of dysostosis, mandibulofacial dysostosis, oculo-auricular syndrome and oto-neuro-endocrine dysplasia. (12 figures, 48 references)

Harri H. Markiewitz.

Woillez, M. and Dansaut, C. **Ocular manifestations in mongolism.** Arch. d'opht. **20**:810-828, Dec., 1960.

The authors have studied two series of patients with mongolism. The first series of 12 had serious ocular disease which brought them to the ophthalmic clinic at Lille. In the second group of 30 the patients were under routine pediatric care and had no specific eye complaints. The eye alterations most commonly found were, in order of frequency, 1. epicanthus associated with obliquity of the palpebral fissures, 2. keratoconus, 3. Brushfield's spots of the iris, 4. lens opacities varying in extent to total cataract, and 5. hypermetropia with or without esotropia. The authors review the extensive literature on the disease since its definition by Langdon Down in 1866 and summarize recent observations bearing on etiopathogenesis. (1 table, 88 references)

P. Thygeson.

20
HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Adams, R. and Fahlman, B., Cluff, L. E., Allen, H. F. and Clark, D. A. **Symposium: Epidemiology and control of hospital infections.** Tr. Am. Acad. Ophth. 65:16-49, Jan.-Feb., 1961.

Adams, R. and Fahlman, B. **Prevention of infections in the operating pavillion.** pp. 16-32.

Practical sterility in the operating room is maintained by rigid enforcement of some simple rules. All surfaces are washed and dried by a suitably garbed and masked attendant who uses an autoclaved mop, bucket and cloth, evacuating the slurry with a wet pickup microstatic cyclonic filter vacuum cleaner. All personnel must scrub thoroughly, wear highly efficient masks and garb which covers the legs, foot wear, and armpits as well as the conventional areas. These precautions reduced the incidence of infections to 0.025 percent and were shown efficient by bacteriologic surveys. (24 figures, 7 references)

Cluff, L. E. **Staphylococcal infections.** pp. 33-43.

Certain factors predispose to staphylococcus infections; for example, trauma, foreign bodies (sutures, intravenous catheters) steroids, extravasated blood in the tissues, local response (there is very high susceptibility in the kidney), infancy and senility, and the presence of enhancing bacteria, and diseases.

At the Johns Hopkins Hospital the incidence of infection was found to be 1.3 percent. The 80/81 bacteriophage type or "hospital strain" is the most resistant to antibiotics, but caused only one-third of the infections. The drug of choice is vancomycin and more recently staphcillin. (4 figures, 1 table, 10 references)

Allen, H. F. **Bacteriology in relation to hospital infections.** pp. 44-46.

To aid in diagnosis, cultures should be in broth as well as on plates. Sensitivities can be speeded up by streaking a four-hour broth culture on agar with the diagnostic discs on the plates. In vitro tests though, are not completely reliable. Intelligent interest can elucidate the epidemiology of hospital and office infections. Environmental samplings must be checked continually, as should methods of sterilization. "Cold" sterilization is not highly recommended. (5 references)

Clark, D. A. **Infections within hospitals from the standpoint of the hospital administrator.** pp. 47-49.

The hospital administrator must be prepared to recognize and accept his responsibilities in hospital infections.

Harry Horwich.

Artelt, A. **History of ophthalmology in Frankfurt am Main.** Klin. Monatsbl. f. Augenh. 138:269-285, 1961.

This is a historical survey of ophthalmologists and ophthalmic practice during the last 2,000 years in the old patrician town of Frankfurt. (5 figures, 48 references)

Gunter K. von Noorden.

Bracaglia, R. and Bucci, M. G. **A review of Scandinavian ophthalmology for the year 1958.** Boll. d'ocul. **39**:767-783, 1960.

A series of cases of glaucoma associated with exfoliation of the lens capsule suggests that it is something other than the obstruction of the trabeculum by debris which is responsible for the glaucoma. In a study of mental patients who had been treated by electrically-induced convulsions it was concluded that this form of therapy did not produce any lens changes. In mothers affected with roseola during the first trimester of pregnancy the authors found that out of 29 births two babies had congenital cataract and six had chorioretinitis. No abnormalities were discovered in 29 newborn whose mothers had contracted roseola during the second trimester of pregnancy. Improvement in retinopathy due to arteriosclerosis followed therapy with a combination of vitamin A and E. (80 references) Joseph E. Alfano.

Cook, Charles. **The history of the Moorfields medical school.** Brit. J. Ophth. **45**: 241-250, April, 1961.

The London dispensary for curing diseases of the eyes and ears was opened on March 25, 1805. In 1810 the practice of the infirmary was first opened to medical students.

Two young American students, Edward Delafield and J. Kearney Rodgers returned to New York to found the New York Eye and Ear Infirmary in 1820. A few years later Edward Renold returned to Boston to found the Massachussets Charitable Eye and Ear Infirmary.

The new Moorfields Eye Hospital foundation stone was laid on May 2, 1821. Organized training was introduced to send out fully trained ophthalmologists to fill consultant posts over a large part of the globe. In 1873 Frank Buller returned to Montreal to pioneer ophthalmic surgery in Canada.

The basic sciences were added to the curriculum in 1920 and Moorfields became a complete school of ophthalmology. In 1948 the Institute of Ophthalmology was incorporated into the University of London. (3 figures) I. E. Gaynon.

Gramberg-Danielsen, B. **Ophthalmologist and traffic laws.** Klin. Monatsbl. f. Augenh. **138**:264-268, 1961.

The oculist may be consulted in legal matters for various reasons. He may have to decide whether a driver's permit can be granted or refused, or whether an already granted license should be revoked in order to eliminate a potential danger. He may have to give an opinion whether a traffic violation or an accident may have been caused by defective optical functions of an individual. In evaluating these questions it is advisable to follow the suggestions of the International Ophthalmological Council. The paragraphs of German traffic laws which are most pertinent to the matters discussed are mentioned. (4 references) Gunter K. von Noorden.

Gramberg-Danielsen, B. **Optical problems in aviation.** Klin. Monatsbl. f. Augenh. **138**:562-565, 1961.

Ultrasonic speeds, acceleration, and lack of oxygen create a number of optical problems. Increased threshold of flicker fusion frequency, impaired dark adaptation, faulty coordination of the extraocular muscles are results of hyperemia. Acceleration may cause extra- and intracranial circulatory disturbances. Ultrasonic speed may lead to anisochromia between environmental reality and visual perception (distance scotoma). (20 references) Gunter K. von Noorden.

Lyle, T. Keith. **Some of the great historical figures associated with Moorfields.** Brit. J. Ophth. **45**:251-258, April, 1961.

John Cunningham Saunders started the practice of ophthalmology in 1800. It must have taken considerable courage to specialize in eye diseases, for at that time such eye treatment as was carried out was almost entirely in the hands of the itinerant quacks who called themselves "oculists."

A short resume of the highlights of the careers of the following men are given: John Richard Farre, Richard Battley, Sir William Laurence, Frederick Tyrrell, Sir William Bowman, Sir Jonathan Hutchinson, Hughlings Jackson, and George J. Guthrie. (10 figures) I. E. Gaynon.

Marin-Amat, M. **The discoveries of Cajal in the innervation of the visual apparatus.** Arch. Soc. oftal. hispano-am. **20**: 1143-1166, Nov., 1960.

The author enumerates in detail Cajal's contributions to the microscopic anatomy of the visual apparatus.

Ray K. Daily.

Sedan, J., Miller, L., Guillat, P. and Farnarier, G. **Professional orientation previous to the study of ophthalmology.** Bull. et mem. Soc. franç d'opht. **72**:585-595, 1959.

Detailed lists of requirements and the potential benefits of a psycho-physical aptitude test previous to the study of ophthalmology are presented by the authors. The advantages and disadvantages of these and similar procedures were outlined during the discussion. (3 figures)

Alice R. Deutsch.

Tower, Paul. **Richard Liebreich and his Atlas of Ophthalmoscopy.** A.M.A. Arch. Ophth. **65**:792-797, June, 1961.

Ophthalmology was fortunate that this artistic eye physician was on the scene during those exciting few years following the invention of the ophthalmoscope. (8 figures, 8 references)

Edward U. Murphy.

Zimmerman, L. E. **The Registry of Ophthalmic Pathology: past, present, and future.** Tr. Am. Acad. Ophth. **65**:51-113, Jan.-Feb., 1961.

This is a comprehensive well-illustrated, authoritative description of the Registry from its inception on. The Registry is rich not only in pathologic specimens, but in photographs, documents, instruments, and history. Today the institute prepares exhibits, courses for teachers, prepares and publishes texts, lends collections for study and gives on-the-job training. An extensive research program has been going on for some time now. This work is to be extended and expanded particularly in the field of world wide geographic pathology. Over 100 publications from the Registry are listed. (39 figures, 5 tables, 93 references)

Harry Horwich.

NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, *Cincinnati 19, Ohio*

News items should reach the editor by the 10th of the month. For adequate publicity, notices of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. William Alexander Boyce, Los Angeles, California, died April 24, 1961, aged 80 years.

Dr. Roy Bartlett Metz, Cleveland, Ohio, died February 12, 1961, aged 86 years.

ANNOUNCEMENTS

EMORY UNIVERSITY COURSE

A postgraduate course in ophthalmology, in which diagnostic methods of examination of the ocular fundus are to be featured, will be presented on Thursday, November 30th, and Friday, December 1st, at the Grady Memorial Hospital, Atlanta, Georgia, under the sponsorship of the Department of Ophthalmology, Emory University School of Medicine.

The course is designed for the practicing clinical ophthalmologist and will consist of lectures and panel discussions by outstanding national authorities on a wide variety of disorders of the posterior segment of the eye. Methods of examination, clinical manifestations, differential diagnosis and pathologic anatomy of many of the lesions of the vitreous, uvea, retina and optic nerve which are encountered in daily practice will be presented in detail.

The guest lecturers for the 1961 course will be Dr. Algernon B. Reese, New York; Dr. Charles L. Schepens, Boston; and Dr. Lorenz E. Zimmerman, Washington, D.C.

CLOSING DATE FOR GRANTS

The National Council to Combat Blindness, Inc., —The Fight for Sight—announces that the closing date for receipt of completed applications for full-time research fellowships, grants-in-aid and student fellowships for the 1962-63 period is March 1, 1962.

In general, notification to applicants for full-time research fellowships and grants-in-aid will go forward in July, with September 1st as the commencement date for the project. Under special circumstances, where earlier notification is judged essential, the Scientific Advisory Committee may consider applications in advance of the scheduled date, but in no event will they be considered for commencement prior to May 1st.

Applicants for student fellowships will be notified in May of the action taken by the Scientific Advisory Committee in order that arrangements may be made with their respective institutions to commerce work in early summer.

Application forms and information outlining the conditions under which these awards are made may be obtained by addressing: Secretary, National Council to Combat Blindness, Inc., 41 West 57th Street, New York 19, New York.

SYRACUSE COURSE

The Department of Ophthalmology of the State University of New York Upstate Medical Center at Syracuse will present its 12th annual postgraduate course in ophthalmology at the Hotel Syracuse, Friday and Saturday, December 1st and 2nd. The following lecturers will participate: Dr. Harold W. Brown, Dr. Irving H. Leopold, and Dr. Joseph A. C. Wadsworth.

The tuition fee is $25.00, payable to the State University of New York Upstate Medical Center at Syracuse, 766 Irving Avenue, Syracuse 10, New York. This fee covers tuition, daily luncheons, and dinner on Friday night. The course is limited to 60 members. These will be accepted in the order in which applications, accompanied by checks, are received. Inquiries regarding the course may be addressed to James L. McGraw, M.D., at the same address.

CALIFORNIA COURSE

A special postgraduate course in ophthalmology on "Diseases of the cornea," will be given at the University of California Medical Center, San Francisco, December 7th through 9th. The annual Proctor Lecture will be delivered on December 8th. For further information and registration forms write: Continuing Education in Medicine, University of California Medical Center, San Francisco 22.

PAN-AMERICAN ASSOCIATION

The interim meeting scheduled for Lima, Peru, January 28 to February 3, 1962, promises to be one of the most interesting and instructive meetings yet held by this active association. All travel information and reservations should be obtained as soon as possible from Mr. E. R. Brown, Harvey Travel Bureau, 2005 West Gray Street, Houston 19, Texas. Enjoyable pre- and postconvention tours are available.

The program will include the following subjects and speakers: Round table, "Diagnosis and medical treatment of glaucoma," Drs. Boyd, McLean, Payne, Scheie, Sugar, Kronfeld, Verdaguer, Malbran, Rocha and Trujillo.

Symposium, "Steroids in ophthalmology," Drs.

Raffo, Gordon, Solanes, Fialho, Diaz, and Barrere.

Papers and round table, "Diseases of the cornea," Drs. Vail, Maumenee, King, Castroviejo, Salleras, Girard, Azeredo and Fine.

Round table, "Detachment of the retina," Drs. Urrets-Zavalia, Barrios, Malbran, Valenzuela, Bulnes and Rodriguez.

Postgraduate courses, Drs. McLean, Maumenee, Boyd, Arruda, Jampolsky, Arentsen, Dena, Hogan, Ferrer, Tribin, Moreno and Arce.

Free papers, movies and exhibits will complete the program. Outstanding social events are planned.

Miscellaneous

Commission on Neuro-ophthalmology

The founding meeting of the Problem Commission of Neuro-ophthalmology was held at the University Neuro-ophthalmological Clinic of the Hospital Cantonal, Geneva, March 18 and 19, 1961.

The founding members are Dr. Ludo van Bogaert, World Federation of Neurology president (Antwerp); W. R. Finks, World Federation of Neurology executive officer (New York); Dr. M. Callens, World Federation of Neurology medical officer (Antwerp); Dr. G. B. Bietti (Rome); Dr. P. Bregeat (Paris); Dr. P. Danis (Brussels); Dr. A. Franceschetti (Geneva); Dr. J. François (Ghent); Dr. P. Guillot (Marseilles); Dr. H. Ikui (Fukuoka); Dr. P. Kissel (Nancy); Dr. F. W. Newell (Chicago); Dr. G. Offret (Paris); Dr. B. Streiff (Lausanne); Dr. C. J. Valdeavellano (Lima); Dr. C. J. Van Slyke (Washington).

The first aim of the Problem Commission of Neuro-ophthalmology is to stimulate contacts between ophthalmologists and neurologists, and to increase the knowledge of neurologic and neuro-ophthalmologic diseases. Given this symbiosis of neurology and ophthalmology, the Problem Commission will facilitate the exchange of information and scientific material between the investigators of both disciplines, establish documentation centers, organize symposia, and improve the techniques of the preparation and examination of histologic preparations. Also the Problem Commission desires closer relations with the specialists of other scientific fields, such as neurogenetics and neurochemistry.

The secretaries of this commission will be Prof. A. Franceschetti (Geneva) for the Eastern Hemisphere and by Prof. F. W. Newell (Chicago) for the Western Hemisphere. The secretaries will be pleased to furnish further information concerning the organization of the Problem Commission and to facilitate contacts with other specialists on this discipline. All inquiries should be addressed to:

Dr. A. Franceschetti, Clinique Ophthalmologique, 22 Rue Alcide Jentzer, Geneva, Switzerland; or to, Dr. F. W. Newell, University of Chicago, 950 East 59th Street, Chicago 37, Illinois, U.S.A.

National Committee for Research

The National Committee for Research in Ophthalmology and Blindness sponsored a "Symposium on the support of research," Saturday, October 7th, at the Palmer House, Chicago. Leaders in research discussed the preparation of requests for support of a research study, sources of funds, training programs, and trends in the support of research. A question and answer session followed the discussion.

For further information about this committee write to Dr. F. W. Newell, secretary, 406-C South Boulevard, Evanston, Illinois.

Ruedemann library

Eliott B. Hague, M.D., prominent ophthalmologist and bibliophile of Buffalo, New York, today presented to Dr. Albert D. Ruedemann, Sr., his well-known collection of ophthalmologic books comprising 1,100 items. The main body of the library consists of rare and historically important ophthalmologic texts, a field that has always been an area of particular interest to Dr. Ruedemann. The oldest and rarest book in the lot is a Bartisch printed in the late 16th century. The collection has been exhibited at many medical meetings including the International Congress of Ophthalmology held in New York City in 1954. The library will form the nucleus of what will be a valuable ophthalmologic library named in Dr. Ruedemann's honor and housed at the Kresge Eye Institute. Dr. Hague acted in behalf of the alumni of Wayne State University College of Medicine and the residency programs at both Detroit Receiving Hospital and Harper Hospital, as well as members of the faculty of Wayne State University College of Medicine. Dr. Ruedemann is chief of the Department of Ophthalmology at both hospitals and chairman of the Department of Ophthalmology at Wayne State.

Societies

The Medical Association of the Instituto Penido Burnier has elected the following officers to serve during 1961-62: President, Dr. Aloysio Afonso Ferreira; 1st secretary, Dr. Alfredo Pôrto; 2nd secretary, Dr. Gilberto Almeida; treasurer, Dr. L. de Souza Queiroz Filho; editorial committee, Drs. Penido Burnier, Antonio de Almeida and Gabriel Pôrto.

Personal

Dr. John W. Henderson has been promoted to head of the Section of Ophthalmology in the Mayo Clinic, at Rochester, Minnesota, succeeding Dr. C. Wilbur Rucker, who will now become a senior consultant.

CHICAGO OPHTHALMOLOGICAL SOCIETY 1962 CLINICAL CONFERENCE

February 16 and 17, 1962
The Drake Hotel, Chicago, Illinois

SPEAKERS

David G. Cogan, M.D., Boston, Massachusetts
Arthur G. DeVoe, M.D., New York, New York
John R. Fair, M.D., Augusta, Georgia
Trygve Gundersen, M.D., Boston, Massachusetts
John S. McGavic, M.D., Bryn Mawr, Pennsylvania
C. Wilbur Rucker, M.D., Rochester, Minnesota
Daniel Ruge, M.D., Chicago, Illinois

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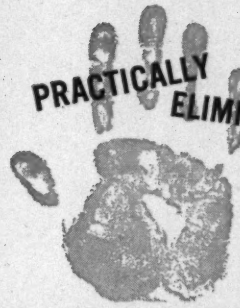
THE EIGHTEENTH ANNUAL GIFFORD MEMORIAL LECTURE

Dr. David G. Cogan, Boston, Massachusetts
Friday, February 16, 1962, The Drake Hotel
5:15 P.M.

The Chicago Ophthalmological Society welcomes all physicians to attend the Lecture. A dinner which follows is open to physicians and their wives.



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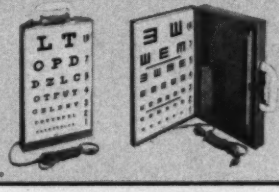

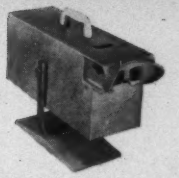

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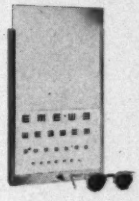

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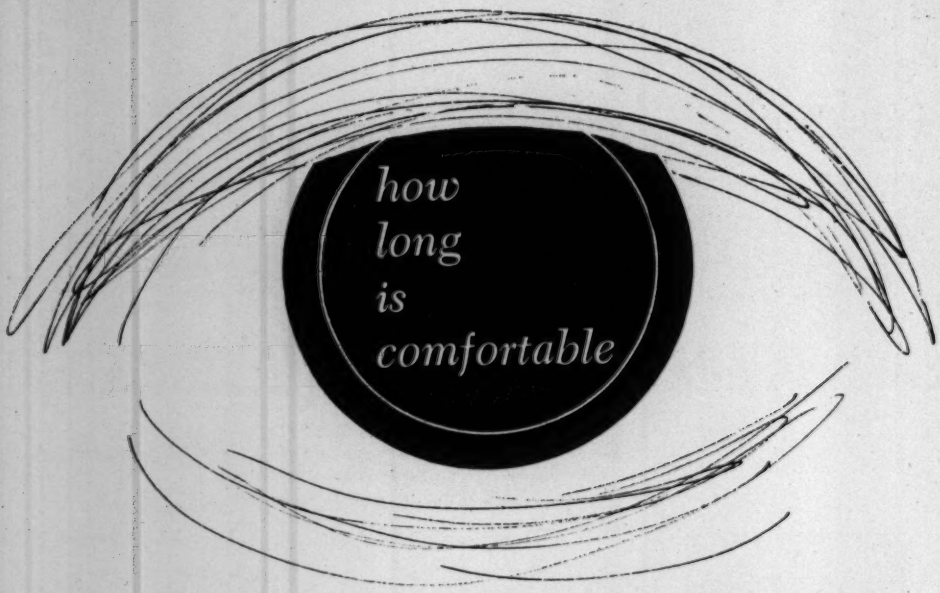

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